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FORTIFICATION OF FIRE POSITIONS

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FORTIFICATION OF FIRE POSITIONS

by

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FORTIFICATIONS OF FIRE POSITIONS

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CHAPTER I

Trenches for Rifle Podrazdelenie

In order to fight a battle more successfully rifle podrazdelenie must first of all utilize the natural conditions of an area and its terrain features. Especially in an area where combat operations have been or are being carried out, there is always a considerable number of various terrain features, especially shell holes, which can be used for conducting fire, maneuvers, and protection, either just as they are or after a small amount of work. However, the greatest facilities for conducting battle and also the greatest protection from the casualty causing factors of an atomic explosion, can be attained by digging individual foxholes or trenches and joining them by connecting trenches.

Modern engineering machines (open trench digging machines) make it possible to dig in a short period of time the necessary number of trenches and connecting trenches. But sometimes, when there is a lack of trench digging machines and especially under conditions of direct contact with the enemy when it is impossible to use the trench digging machines, the troops will be forced to dig trenches by hand. Under these conditions at first it is necessary to dig foxholes and after that trenches and connecting trenches.

The trench is a narrow ditch which is of varying length, from several meters to tens of kilometers.

Most trenches, both those dug by means of trench digging machines and those dug by hand, are made 1.1 meters deep (Figures 1, 2). Such a trench depth is enough for concealed communication and protection from the effect of various means of destruction. At the same time it is possible to conduct fire from a trench 1.1 meters deep, standing on the bottom of the ditch, without constructing firesteps.

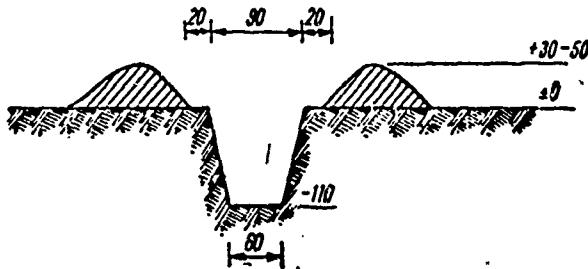


Figure 1
Profile of a trench dug by trench digging machines BTM and ETR-152

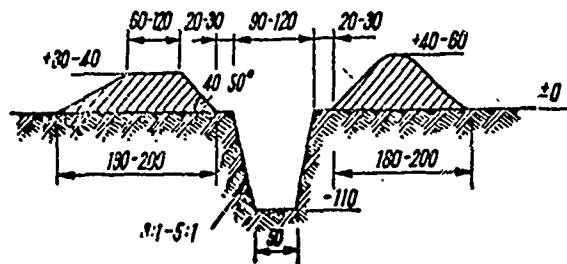


Figure 2
Profile of a trench dug by hand (the height of the brestwork
is 40-60 cm)

For digging 1 running meter of trench 1.1 meters deep and in
average soil 0.8 manhours are required

Trenches 1.5 meters in depth which are constructed employing
mechanical means and by hand (Figures 3, 4) permit movement along them
fully erect. However, building such trenches requires much effort and
time.

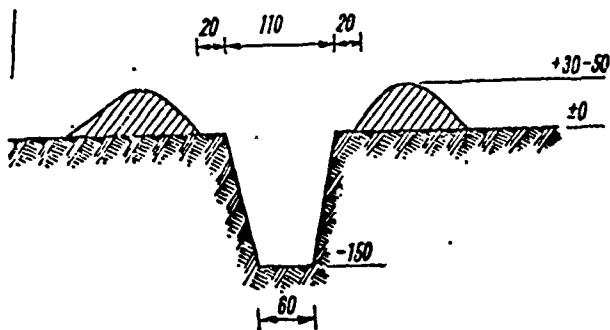


Figure 3
The full profile of a trench dug by a fastmoving trench digging
machine BTM and a rotor trenchdigger ETR-152.
The productivity of the machines when digging trenches 1.5 meters
deep is 300 running meters of trench in an hour for the fast moving
trench digging machine BTM, and 150 running meters of trench in an
hour for the rotor trench digger ETR-152

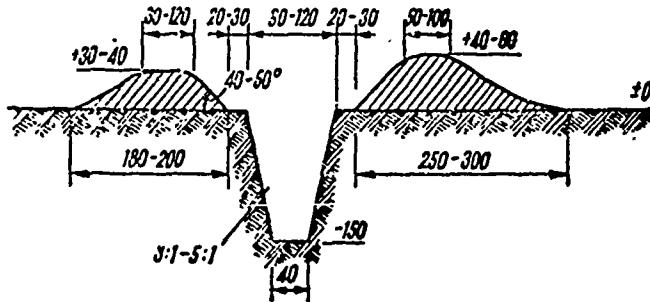


Figure 4
Full profile of a trench dug by hand. For digging 1 running meter
of trench 1.5 meters deep in average soil 1.3 manhours are required.

In the role of a defensive installation the trench serves primarily as a fire position for riflemen, submachine gunners, machine gunners and several infantry anti-tank facilities, and also as a cover for personnel and equipment, protecting them not only from the usual means of destruction but also from an atomic explosion. Furthermore, along with the communication trenches a trench makes possible movements along the front and to the rear which are concealed and protected from enemy fire. It assures convenience in controlling podrazdelenie in battle, and, finally, a system of trenches and connecting trenches creates favorable conditions for the camouflage disposition of infantry podrazdelenie in positions. Trenches are employed chiefly when setting up defensive positions, and also in preparing attack positions and offensive zones.

A trench accomplishes its mission only when it is skillfully placed on the terrain and properly organized.

Depending on the assigned combat mission and the terrain conditions, trenches can be placed at the base of a height, on a forward slope, near a topographic crest and on reverse slopes. In situating the trenches special attention should be given to providing the possibility of conducting anti-tank fire from infantry anti-tank weapons at point-blank range.

When the trench is situated at the base of an elevation communication with the rear is made difficult since in this case the communication trenches would be observed from the ground observation points of the enemy. But then when so located the trenches are provided with a good flat fire.

When the trench is situated on a forward slope or near the topographical crest the conditions for communication with the rear are improved and an attack by the enemy infantry is made difficult since it will be forced to get over the uphill slope. The observation and field of fire of the approaches to the elevation will be made difficult due to the presence of dead spaces.

When trenches are placed on the reverse slope they should be removed from the topographical crest for a distance permitting effective use of infantry anti-tank weapons, but no closer than 400 meters.

When locating the trench in terrain where camouflage is considered necessary, that is, the trench should be dug so that it will not be observed by the enemy, it should be located in grass, a bush, or among trees. In so doing the capability of conducting fire from the trenches should not be forgotten.

If there are natural anti-tank obstacles in the terrain the trenches should be situated behind them. Furthermore, this should be done so that the part of the terrain accessible to a tank can be covered by flank or oblique fire from the trench.

After the trench has been dug by the trench digging machine its organization entails the setting up of areas for infantry anti-tank weapons, digging holes and setting up areas for the delivery of fire and observation of the field of battle, widening areas for the disposition of men during movements to contact and erecting the simplest coverings for personnel and equipment.

The organization of trenches must not reveal the location of the podrazdelenie. Firing positions, emplacements, overhead cover of the trench sections and other structures erected during the organization of the trenches must be placed equally on the positions of the podrazdelenie and on the intervals between them. When structures (firing positions, emplacements, and others) are situated only in positions occupied by the podrazdelenie, they should be carefully camouflaged from enemy air and ground observation.

Ordinarily the trench digging machines dig a trench which is 1.1 meters deep with a brestwork 0.3-0.5 meter high, which is sufficient for concealed movement. Deepening of the trench is necessary only in individual sections, namely, where they can be observed from enemy ground observation points. This work is accomplished only after blindages and shelters have been built for personnel.

It is not necessary to level the brestwork after the work of the trench digging machine since this work on sections occupied by podrazdelenie will disclose their positions, and considerable expenditure of work and time is required for leveling the brestworks of the entire length of trench.

It is advisable to place close together firing positions and emplacements for the conduct of fire from machine guns, grenade launchers and other infantry weapons, (Figure 5). Adjoining firing positions and emplacements, in comparison to outlying firing positions and emplacements are easy to camouflage since they are not connected by a ditch which is easy to spot from the air.

Adjoining firing positions and emplacements are designed for the conduct of flank, oblique and frontal fire. For the conduct of flank fire firing positions and emplacements are usually placed in areas where the trench changes its direction (Figures 6, 7). For the delivery of frontal fire firing positions and emplacements are located in straight sections (Figure 8) and in angles where the trench turns in our direction.

When there is time and materials several adjoining firing positions are equipped with a covered embrasure and an overhead trench cover (Figure 9) which protects the men in the position from incendiary agents and war gas which is sufficiently liquid to form drops.

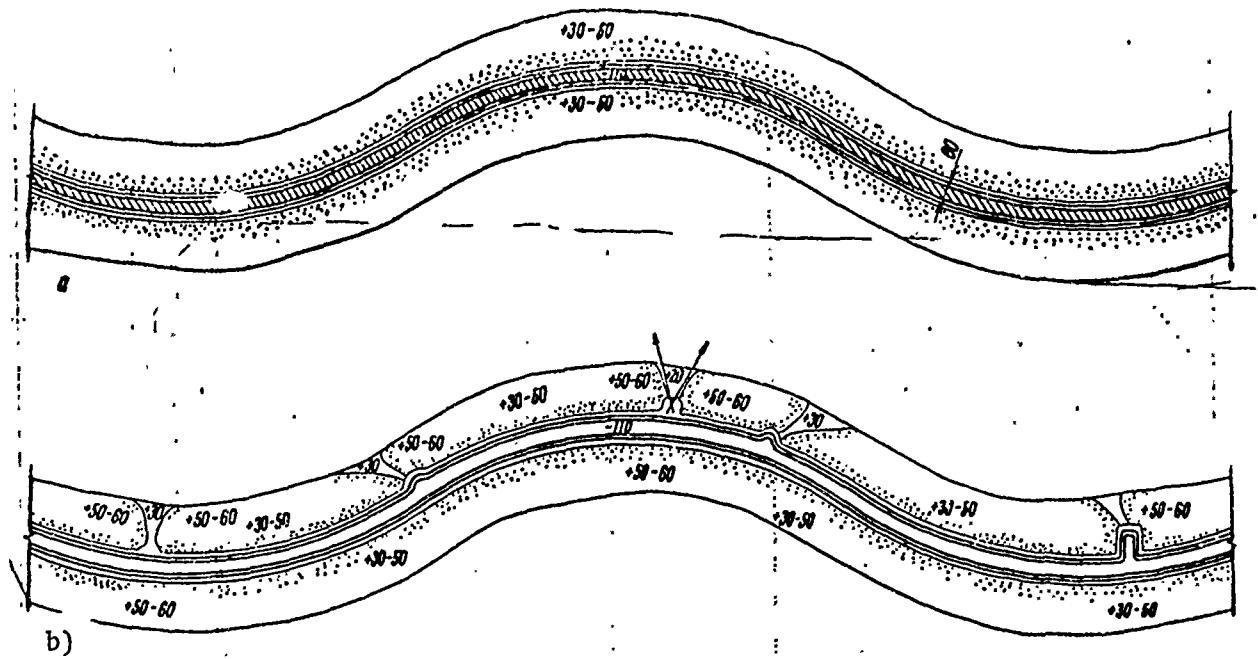


Figure 5

The sequence for organizing a trench dug by mechanisms for a rifle squad position:

a) trench dug by a trench digging machine; b) the organization of adjoining firing positions and emplacements. The construction of 50-60 running meters of trench requires 0.1 machine hours

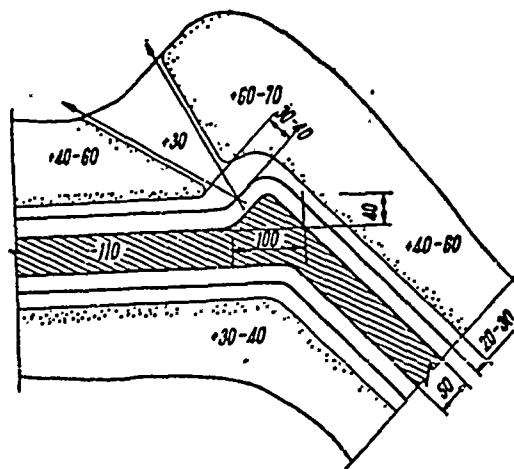


Figure 6

An adjoining firing position (for the delivery of flank fire). The amount of soil removed is 0.6 m^3 . 0.7 manhours are required for the construction.

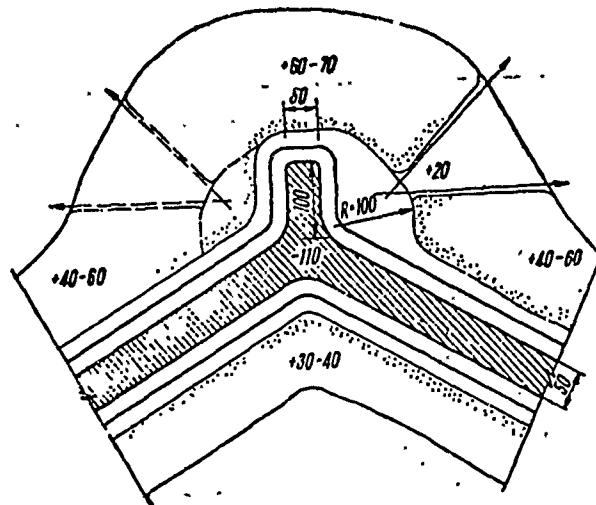


Figure 7
An adjoining emplacement for a machine gun (for the delivery of flank fire).
The amount of soil removed is 1.5 m^3 . 3.0 manhours are required for the construction.

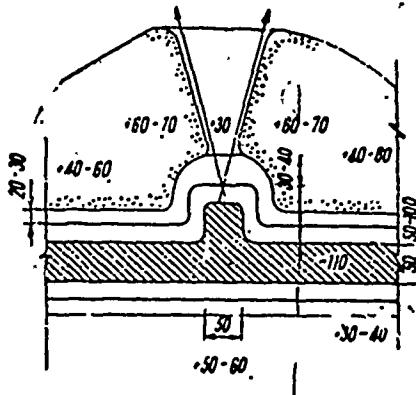


Figure 8
Adjoining firing position (for the delivery of frontal fire).
The amount of soil removed is 0.5 m^3 . 0.6 manhours are required for construction.

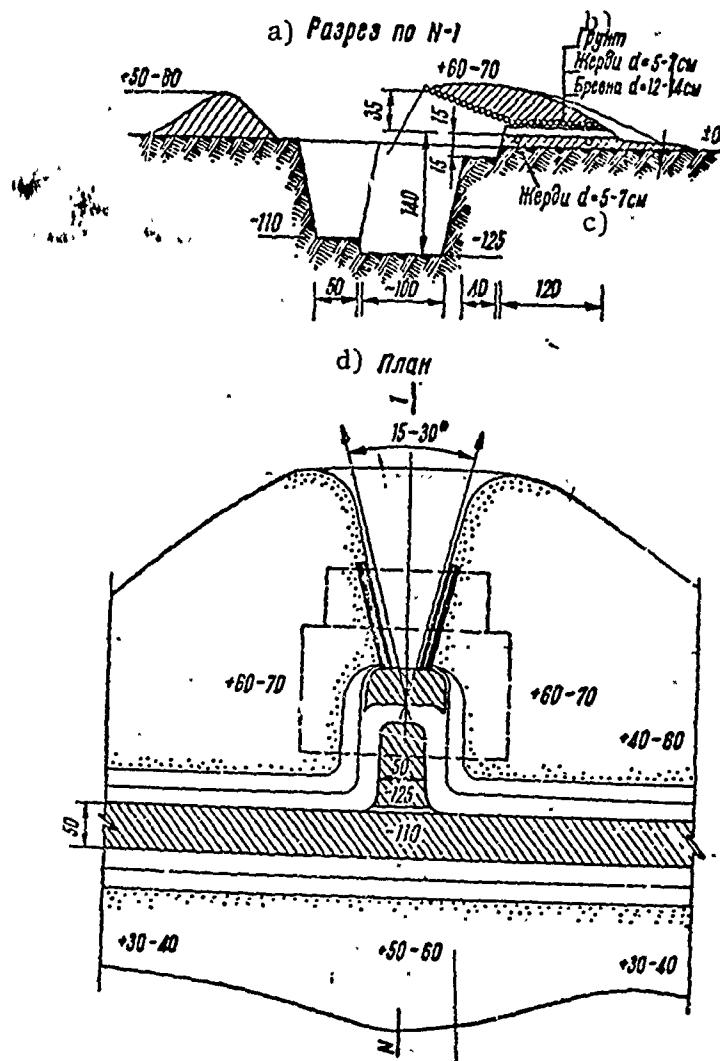


Figure 9
A covered embrasure with an overhead trench cover above and adjoining firing position.

1.5 manhours are required to construct the embrasure.

a) Profile N-1; b) Ground; Poles $d = 5-7$ cm; Logs $d = 12-14$ cm;
c) Poles $d = 5-7$ cm; d) Plan

Outlying firing positions improve defense of the men located in them and make it possible to better subject to fire the approaches to the position. Such a disposition of foxholes makes movement along the trench easier.

Dead ends and enlargements in the trenches are set up at distances of 40-50 m one from another for the deployment of men during a movement to contact in the sections occupied by the podrazdelenie.

The length of a dead end or an enlargement should be no less than 2.5 meters and the width along the bottom about 60 cm. This is done so that stretchers bearing wounded can be placed in the dead end or enlargement.

There is no need to dig special foxholes in the rifle squad position for observing the field of battle. The ordinary foxholes can be used for this purpose.

Furthermore, in sections of the trenches occupied by the podrazdelenie the simplest coverings are set up (open or covered slit trenches for 2-3 men, covered sections of the trenches, recesses for 1-2 men and pits for grenades and other ammunition supplies). A description and designs for the simplest covered positions for personnel are given in Chapter II.

The trenches are organized by the infantry and machine gun podrazdelenie themselves, and also by the anti-tank weapons podrazdelenie. First the trenches are organized in the sections which are occupied by the podrazdelenie, and then in the intervals between them. The nature of the full organization of a trench after it has been dug by mechanical means is shown in Figure 10.

In a combat situation it may occur that the podrazdelenie is able to dig foxholes before the arrival of the trench digging machines. In this case it is necessary to dig the trench using the trench digging machine taking into account that maximum use should be made of the already dug foxholes, which, as a rule, must be converted into outlying firing positions.

Trench digging machines cannot be employed everywhere. This cannot be done, for example, under the conditions of direct contact with the enemy, when trenches are dug in an area subject to his aimed fire and ground observation, and also if there are no mechanized facilities. Sometimes also the terrain conditions do not permit the use of a machine (for example, this may not be done in marshy sections, on steep slopes, in rocky soils, etc.). In these cases the rifle, machine gun and other podrazdelenie begin the digging of the trenches themselves.

Entrenching by the podrazdelenie involves using small or large shovels to dig first single foxholes, and then foxholes for a squad and, finally, converting them into a continuous trench. Depending on the battle situation the entrenching is done prone, on the knees or standing.

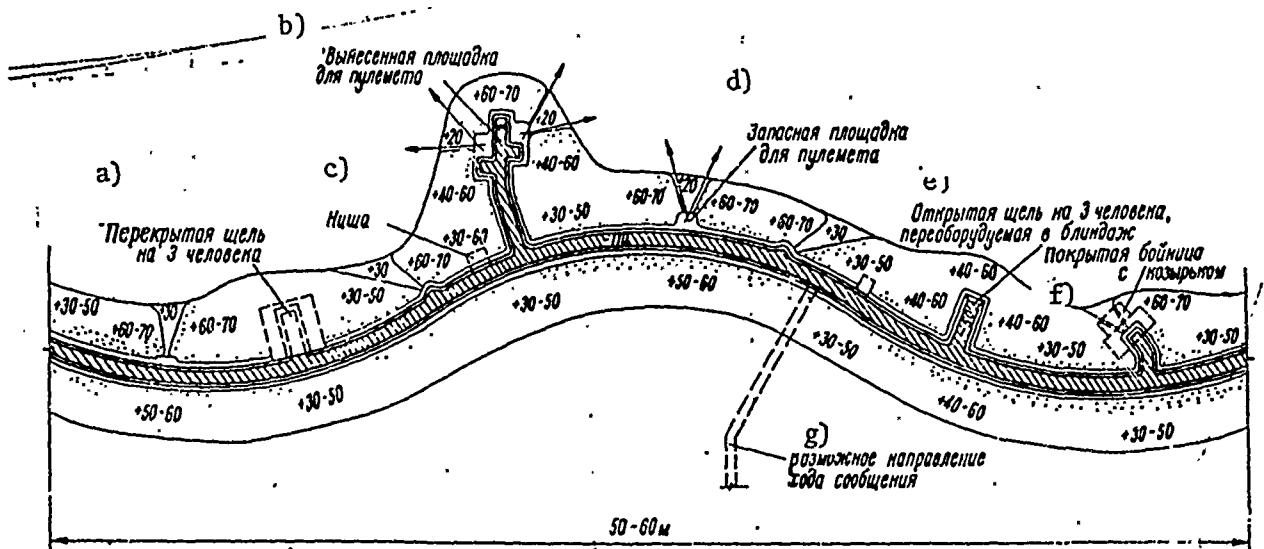


Figure 10
An organized section of a trench which makes up the basic position of a rifle squad after digging with its trench digger.

The amount of dirt removed prior to organizing is 25.0 m^3 . For organizing the trench 45.0 manhours are required.

- a) covered slit trench for 3 people; b) an outlying machine gun emplacement; c) an ammunition pit; d) a reserve machine gun emplacement; e) an open slit trench for 3 people, reorganized into a blindage; f) a covered embrasure with an overhead trench cover; g) a possible direction for a communication trench.

After the firing line is occupied a soldier should dig a prone trench as fast as possible (Figure 11). Such a trench provides the best defense from a bullet, fragments and a blast wave in comparison with a man situated on open terrain. The trench is dug so that its dimensions provide complete concealment for a man in a prone position.

When there is time the depth of the trench is increased up to 0.6 meters. Such a trench makes it possible to fire from a kneeling position (Figure 12); it makes the man lying on its bottom safe from the effect of a blast wave of an atomic explosion. If time permits the kneeling type of foxhole is made deeper, and as a result a standing type trench is created (Figure 13).

In individual cases it is advisable to dig two-three man foxholes for standup firing (Figure 14). Such a disposition of men in the foxholes makes it possible to organize better mutual support, and it also somewhat reduces the time of digging the foxhole.

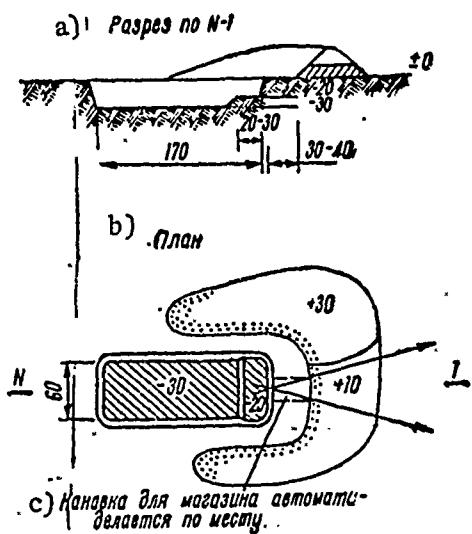


Figure 11
A single prone trench.
The amount of soil removed is 0.3 m^3 . 0.5 manhours are required to dig it.
a) Profile N-1; b) Plan; c) Ditch for magazine of automatic machine gun - as needed

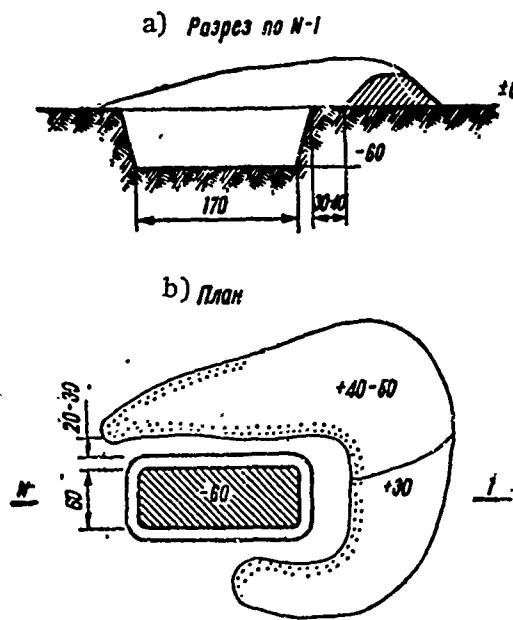


Figure 12
A kneeling type foxhole.
The amount of dirt removed is 0.8 m^3 . 1.5 manhours are required for digging it.
a) Profile N-1; b) Plan

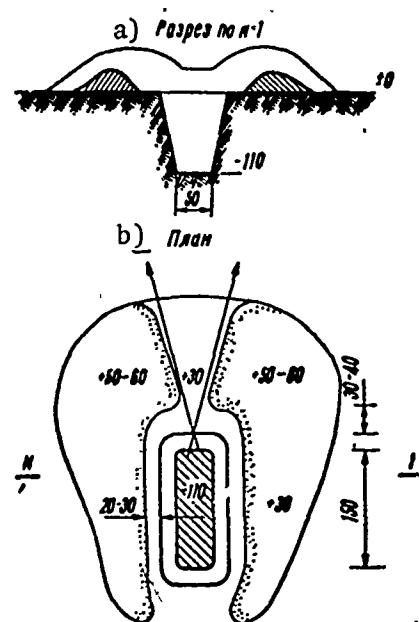


Figure 13
A standing type trench.
The amount of dirt removed is 1.4 m^3 . 2.5 manhours are required for the digging.
a) Profile N-1; b) Plan

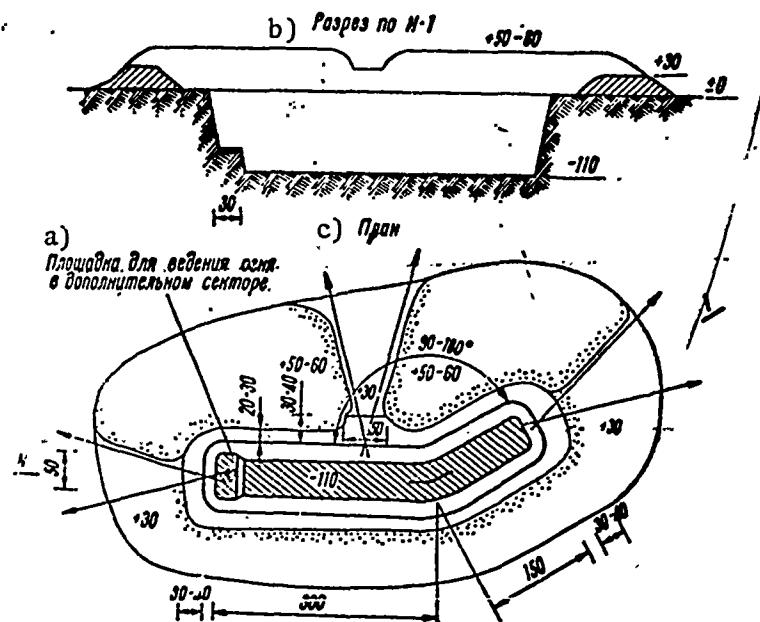


Figure 14
A two-three man foxhole.
The amount of dirt removed is 3.6 m^3 . 4.5 manhours are required to dig it.
a) An emplacement for delivery of fire in an auxiliary sector; b) Profile N-1; c) Plan

The sequence of construction of foxholes for machine guns (Figures 15-17) is the same as for foxholes for riflemen.

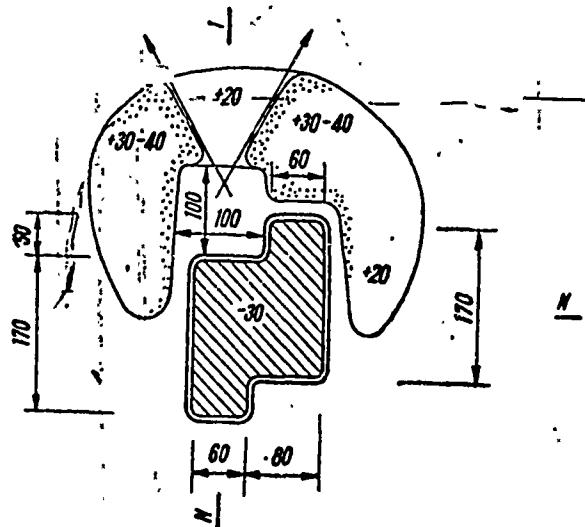
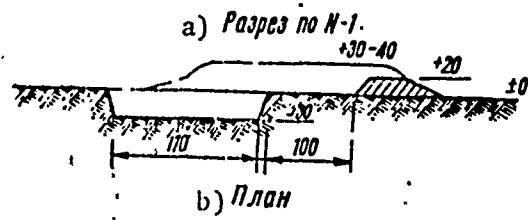


Figure 15

A prone trench for a machine gun. The amount of dirt removed is 0.8 m^3 . 1.5 manhours are required for digging it.

a)Profile N-1 b)Plan

Following the construction of the standing type foxholes they are connected by a ditch. The new trench created in this manner is called a trench for a rifle squad.

The stages in the construction of a trench for a rifle squad when the work is done by hand and when exposed to enemy fire are illustrated in Figure 18.

When digging foxholes and trenches in loose or filled soils their slopes are covered to keep them from collapsing. Poles, wattle fences, dirt filled bags and similar materials are utilized in reversion of slopes (Figures 19, 20).

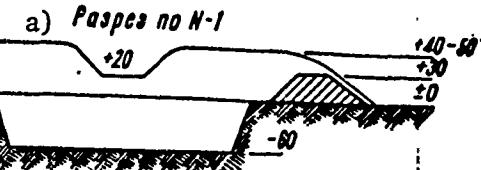


Figure 16

A kneeling type foxhole for a machine gun. The amount of dirt removed is 1.5 m^3 . 2.5 manhours are required for digging it.

a)Profile N-1 b)Plan

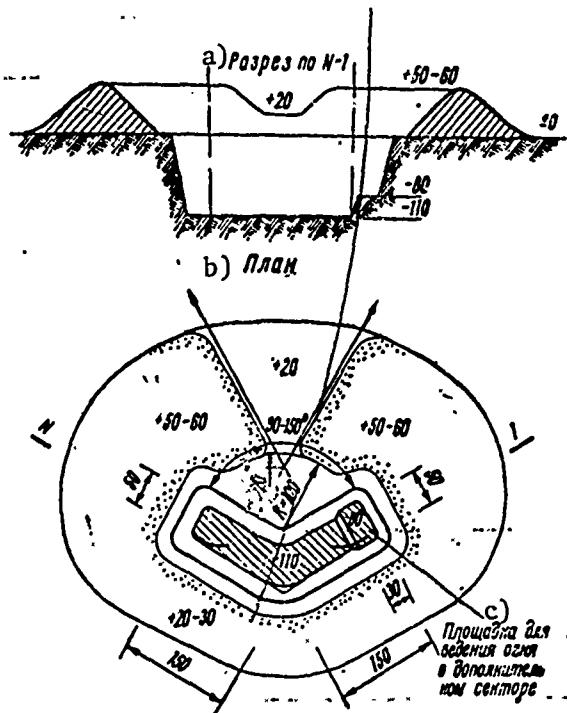


Figure 17
A standing foxhole for a machine gun (for delivery of frontal fire).

The amount of dirt removed is 2.3 m^3 . 5.0 manhours are required for digging it.

a) Profile N-1; b) Plan; c) Emplacement for delivery of fire in an auxiliary sector

During the reconnaissance for and construction of trenches and communication trenches it is necessary to pay special attention to protecting them from surface waters. We remember that during the Great Patriotic War there were cases in the fall and spring when foxholes and trenches became filled with water, and as a result made it necessary to abandon them and occupy new positions on higher ground.

In order to protect the trenches and communication trenches from surface water they should be placed on the slopes of elevations. Locating structures in low places along the bottom of hollows, dry river beds and the like is not recommended since they can be flooded by surface waters. The bottom of foxholes, trenches and communication trenches should be no less than 25 cm higher than the ground water level.

In sloping areas mountain drainage ditches are dug 5-10 meters from the foxhole or trench on the uphill side. The mountain ditches are made up to 40 cm deep and 20-40 cm wide. The water from the mountain ditches is drained into depressed areas, and if there are no such areas it is passed through the trenches and communication trenches by means of

wooden gutters. For getting rid of water which has entered the trench drainage ditches are built from which the water collects in a reservoir or a water absorbing well. A ditch 10 cm deep is dug at the base of the rear slope of the trench.

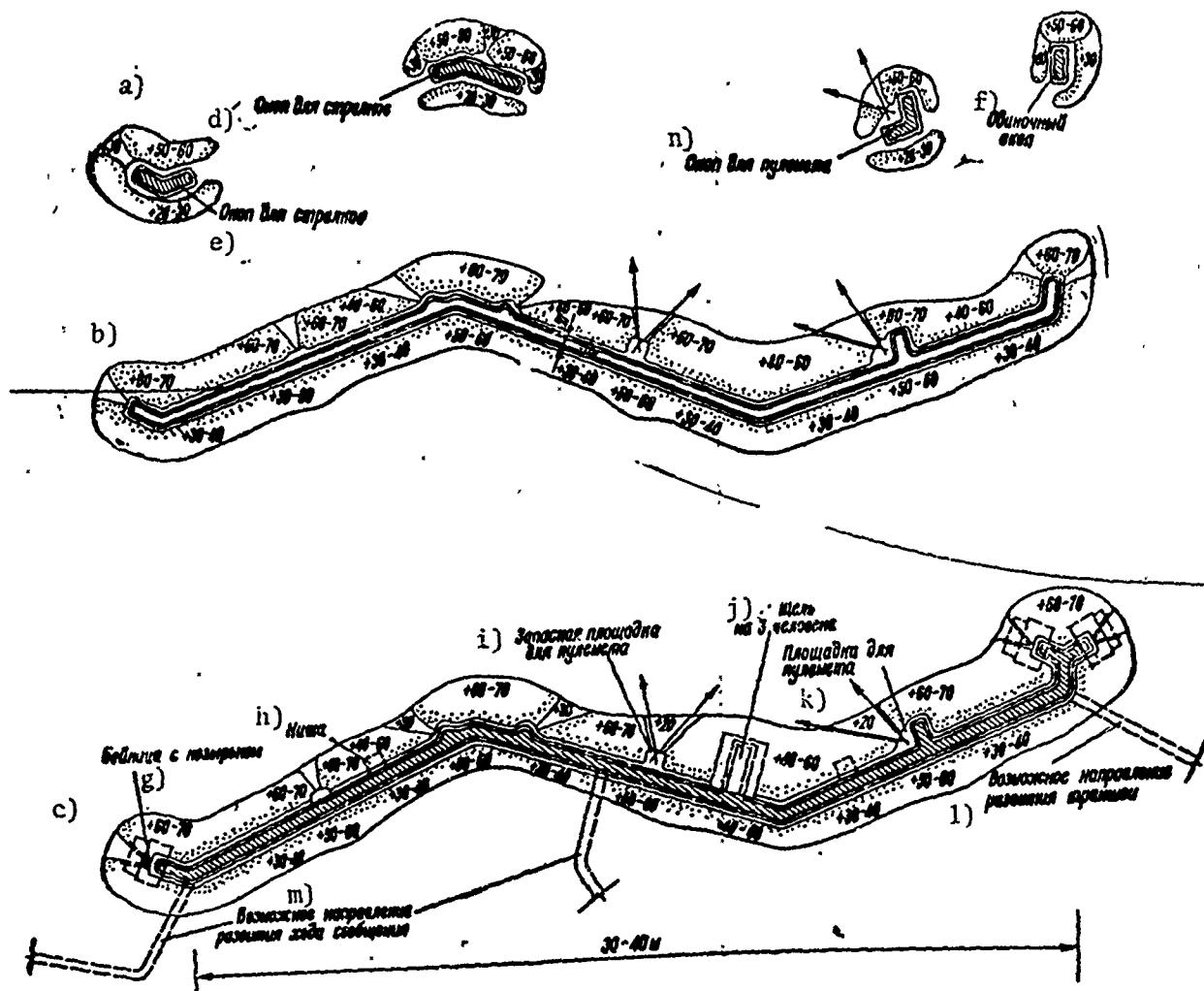


Figure 18

Stages of development of rifleman and machine gunner foxholes for a rifle squad when there is manual digging of the trenches:

squad when there is manual digging of the trenches:

- a) organization of one-man foxholes and foxholes for two-three riflemen and machine gunners; b) the organization of a connecting ditch between the one-man foxholes and the organization of adjoining firing positions and emplacements; c) the organization of the simplest covers for personnel, of ammunition pits, of covered embrasures and the like; d) trench for riflemen; e) trench for riflemen; f) one-man foxhole; g) embrasure with light overhead cover; h) recess; i) reserve machine gun emplacement; j) 3-man slit trench; k) machine gun emplacement; l) possible direction of trench development; m) possible direction of connecting trench n) machine gun window development

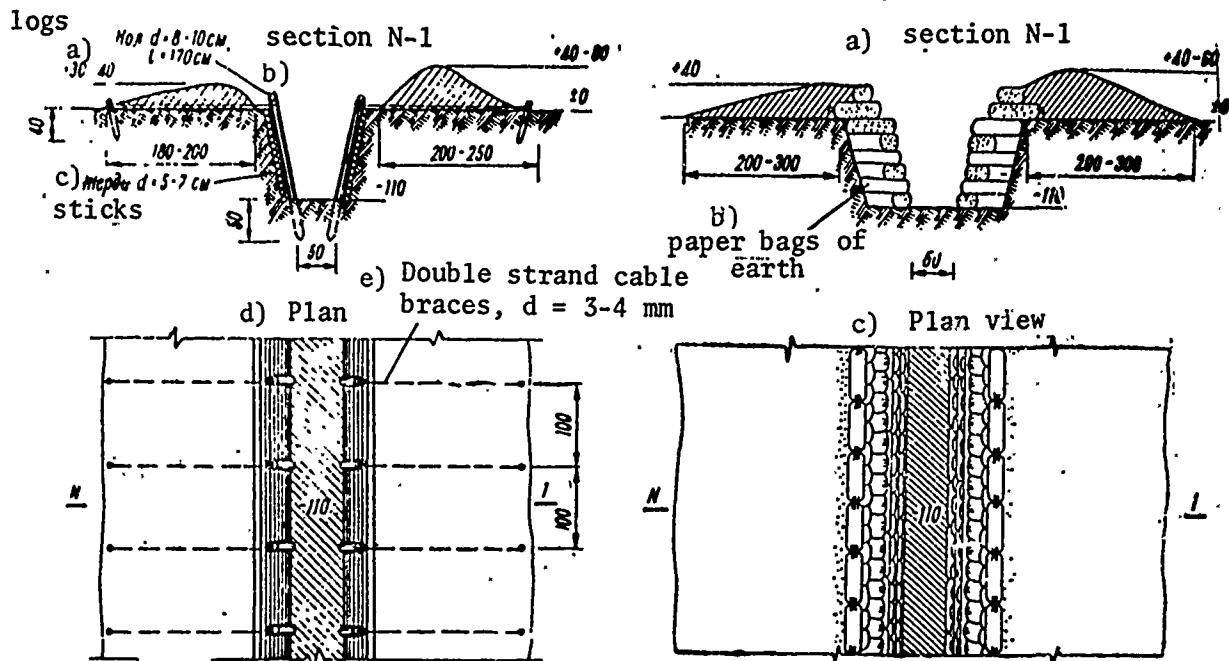


Figure 19
Revertment of trench slopes made
from poles. 10 running meters
of trench require 30 manhours
for revertment

Water-collecting wells are made 75-100 cm deep in low lying sections of the trench. The walls of the well are strengthened with boards, poles and brushwood. The water is removed in buckets from the water collecting well.

Water absorbing wells are constructed when below the earth which is not impervious to water there lies ground which absorbs water well. The wells are dug 15-20 cm lower than the ground not impervious to water and are filled with rubble or coarse gravel.

Trenches, as observed from the air and also on aerial photographs have the appearance of a twisting black band fringed on both sides with light strips (rarely on one side) of dug ground (Figure 21).

The sharp contrast between the dark and the light strips of great length bordering it facilitate considerably the reconnaissance of trenches.

Figure 20
Revertment of trench slopes made from
dirt filled bags. 10 running meters
of trench require 20 manhours for
revertment

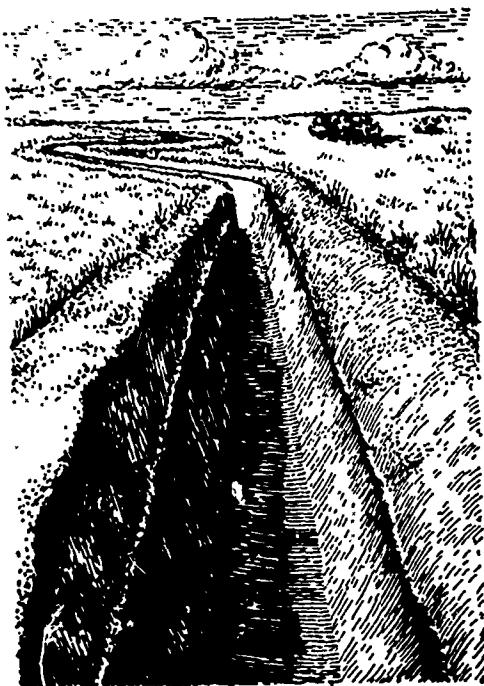


Figure 21
An uncamouflaged trench after being dug by a
trench digging machine.

The nature of the organization of the trenches (the presence of positions, emplacements, slit trenches, overhead concealed sections and the like) can be established by the widened sections of the trenches and the increased parapets beside them.

If there are many trenches and foxholes on the positions it is impossible to conceal them entirely. Individual foxholes and sections of trenches can be completely concealed when flat camouflage-overhead cover has been used for this (Figure 22). The frames of the camouflage-overhead concealment are made from poles and wire. The width of the camouflage-overhead concealment is determined by the presence of materials and it can conceal the ditch of the trench or even the trench and the parapets. The overhead concealment of the ditch should always be on the same level with the parapet and the traverse of the trench. The camouflage material which is woven into the camouflage-overhead cover as a rule is not confined to the limits of the ditch and parapet, but it should take in also the terrain adjacent to the trench. The intertwined camouflage material must correspond to the design and background of the terrain on which the camouflage-overhead cover will be placed. If the foxholes and trenches are situated on a meadow background the sections of the parapet protruding beyond the general outline are camouflaged with materials at hand. In some cases individual sections of the trench parapet can be covered with turf.

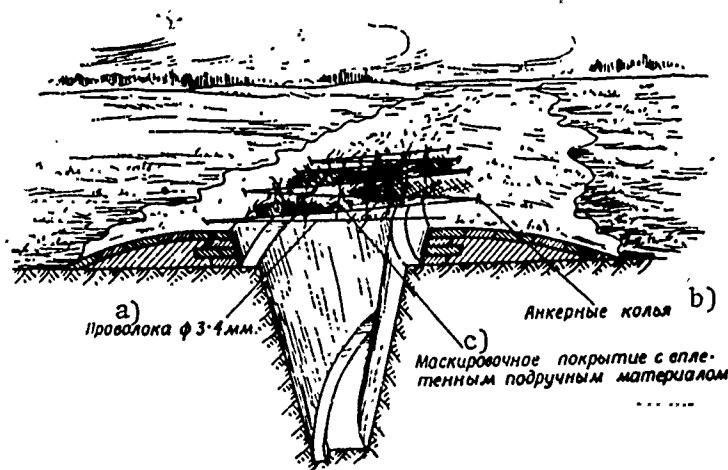


Figure 22
 Camouflaging of a trench with a flat
 camouflage-overhead cover.
 a) wire F 3-4 mm; b) anchoring pickets;
 c) camouflaged cover with intertwining
 at-hand material.

The turf is best prepared in places where the grasses are similar in growth to the terrain adjacent to the trench or foxhole: for turfing parapets in high places the turf is taken from high places, and for turfing parapets in low places the turf is taken from low places. The dimensions of the sods are 40 x 20 cm, with a thickness of 5-8 cm.

Nets which have intertwined in them camouflage material (bands of fiber or of special camouflage paper, grass, branches) or camouflage cover made from fabric meshwork are placed on the assembled frame of the camouflage-overhead cover.

Cut vegetation used for camouflaging quickly wilts and changes its color. Therefore, in the majority of cases coniferous branches, which even in the summertime do not change their color for a long time (up to approximately 20 days) will be used as camouflage material.

For camouflaging ditches in a field it is best to use small brushwood which has been cleared of leaves and laid in rows parallel to the stripes of the field. A camouflage-overhead cover which conceals only the trench ditch is usually used on the background of the field. The parapet is camouflaged, sprinkling it with a layer of earth and simulating furrows on it, repeating the general design of the field's background. On a field where cereals have been harvested the brushwood is strewn with straw. The authorized camouflage cover made from a fabric meshwork corresponding to the color of the field may be employed on the background of the field (Figure 23).

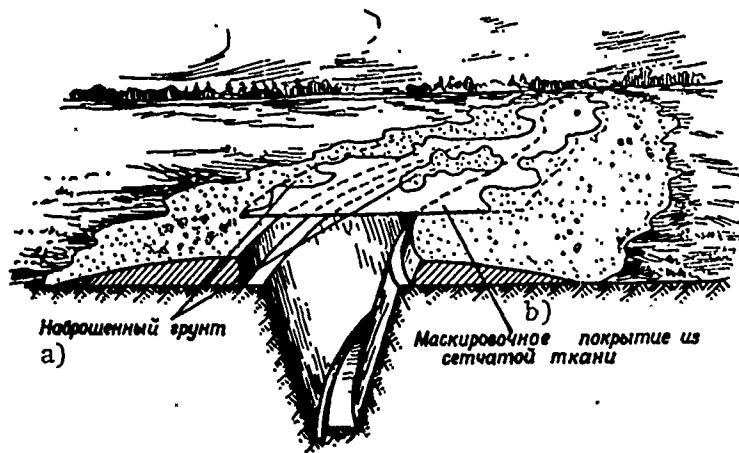


Figure 23
 The camouflage of a trench ditch in imitation of a background of excavated soil.
 a) excavated soil; b) camouflage cover made from fiber meshwork.

In winter the snow conceals the parapets of foxholes and trenches well. For camouflaging the ditch or trenches a framework made from poles or wire is put over it, and then the frame is covered with a net, on top of which hay, straw, or spruce branches are strewn. The foundation prepared in such a manner is covered with a layer of snow about 10 cm deep. White cloth can also be used as cover, for example, the authorized camouflage kits made from fabric meshwork. A trench ditch can also be concealed by an arch of snow which is devised by using a portable wooden form or an arched camouflage-overhead cover. The camouflage-overhead cover consists of a pole frame braided with brushwood on top of which are placed evergreen branches and other materials, and then sprinkled with a layer of snow.

It is necessary to conceal especially carefully the battle organization of trenches (firing positions, emplacements for machine guns and mortars, observation positions and the like).

If the combat and administrative organization of trenches is well camouflaged and appearance of inactivity on the part of their troops is afforded and the enemy will be deceived in regard to the entire deployment system of firing installations.

It is most advisable to camouflage adjoining firing positions for riflemen and emplacements for machine guns and mortars in imitation of the trench parapet. To this end an overhead cover made from authorized covers of desert backgrounds corresponding to the background of the parapet are set up above the firing positions and emplacements.

If there are no authorized covers then overhead covers are made from brushwood.

That part of the parapet, emplacement or firing position which juts beyond the boundary of the parapet of the trench is camouflaged with materials at hand in imitation of the terrain background.

Outlying firing positions and emplacement can be concealed also by camouflage-overhead covers which imitate the background of the surrounding terrain (Figure 24). The frame of the overhead cover which is set up over the outlying firing positions or foxholes is covered by local materials (grass, branches, leaves and the like). A communications trench connecting a firing position with the trenches is camouflaged partly in imitation of the background of the surrounding terrain and partly in imitation of the background of freshly spread dirt.

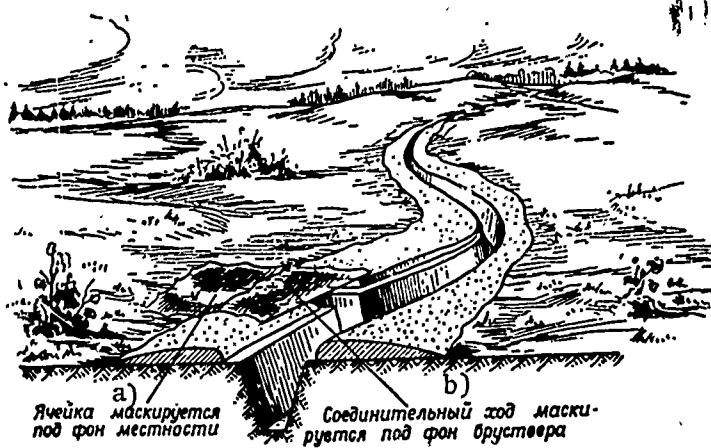


Figure 24
The camouflaging of an outlying firing position by a camouflage-overhead cover.

a) firing position is camouflaged in imitation of the terrain background; b) the connecting passage-way is camouflaged in imitation of the parapet background.

The frames for the camouflage-overhead covers above the firing positions and emplacements are made from poles and are set up over the parapet so that it is possible to conduct aimed fire. The openings of embrasures are concealed by frames of different designs which are raised and lowered and which are made from materials at hand, and also by aprons with camouflage materials attached to them (Figure 25).

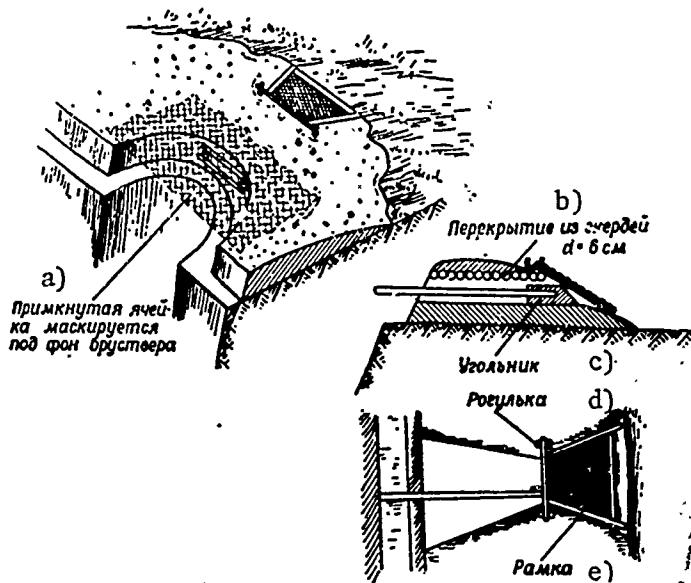


Figure 25

A movable frame device in front of an embrasure.

a) an adjoining firing position is camouflaged to correspond with parapet background; b) an overhead cover made from poles. d = 6cm; c) set-square; d) fork; e) frame.

Organizing the camouflage operations during the erection of the foxholes and trenches is of considerable importance for their camouflaging. It is necessary to organize the camouflaging of the installations so that the areas which have been camouflaged will not be trampled down during the process of further construction on the foxholes and trenches.

Furthermore, the approaches to the work area should correspond with some kind of natural terrain lines, for example, boundaries, ditches, roads or paths. The camouflaging of a trench proceeds so that the ditch is camouflaged first and after that the parapet.

To give the enemy a false outline of our positions dummy structures are set up, for example, decoy trenches which are erected simultaneously with real trenches. It is advisable to organize the dummy structures during the daytime, and outwardly they should resemble actual trenches. A part of the dummy structures, especially those located near the main line of resistance, should have machine guns or automatic machine guns fired from it. Otherwise, the dummy position of a podrazdelenie will not be taken as a real one by the enemy. Foxholes, sections of trenches and firing positions which have not been fully dug out, while still permitting delivery of fire from them, can serve as dummy structures.

It is recommended that dummy structures, trenches and foxholes be located in accordance with the accepted system of fire at a distance of 75-100 m from the real structures, that is, so that they will be placed outside the ellipse of dispersion of field artillery shells.

CHAPTER 2

The Simplest Cover for Personnel

Under battle conditions the troops do not always have time to construct covered positions. Therefore, it is quite important for the troops to know the natural protective and camouflaging facilities of the terrain and to know how to use them in all forms of combat activity.

The terrain relief elements (ravines, hollows, the reverse slopes of elevations and the like), woods and terrain features (ditches, culverts, grooves and embankments of roads, shell holes, stone fences, mines, tunnels, caves, and the like) can be utilized for camouflaging and protecting personnel, combat equipment and vehicles.

The shock wave of an atomic explosion knocks down ground structures, trees and so forth. Therefore, personnel located in the zone of its effect can be injured not only by the shock wave but also by flying fragments of structures, stones, trees, and so forth.

When there is an atomic explosion which is detected first of all by a blinding flash each soldier must immediately occupy the natural protective cover located near him. If there is no such protective cover nearby, it is necessary to lie on the ground with the legs extended in the direction of the blast, face down and eyes closed.

The luminous radiation of an atomic blast, in contrast to its shock wave, has a long duration. Thus, according to foreign data, the duration of the luminous radiation from an atomic explosion with the power of 20 thousand tons is about 3 seconds, and from an explosion with the power of 1 million tons, it is about 12-25 seconds. In the case of an atomic explosion with the TNT equivalent of 20 thousand tons a man can receive third degree burns at a distance of 2.5 km from the epicenter of the blast. Luminous radiation blinds the man for a considerable time. In connection with this it is necessary to protect the eyes from the direct effect of the luminous flux, utilizing natural protective cover for this.

Along with protection from the shock wave and luminous flux the protection of personnel against injuries from penetrating radiations is extremely important. A single dose exposure to a man from penetrating radiations equaling 400 r in the majority of cases is fatal. Therefore, it is necessary to rapidly and skillfully utilize the natural protective cover on the field of battle which will considerably reduce the dose of penetrating radiation and maintain the combat capacity of the personnel.

If there is time and materials the terrain features should be arranged to increase their protective characteristics, or the simplest types of protective cover which possess better protective characteristics

than some natural cover should be organized. Protective covers are intended not only for protection against means of destruction but also for a place for the personnel to rest, receive rations, and for protection against cold and bad weather, especially during the cold period.

Let us consider the simplest protective covers which troops can set up under various conditions of a combat situation and of terrain.

Recesses, covered sections of trenches and communication trenches, open and covered slit trenches, stone parapets and other simplest protective covers are set up in the positions and in areas where the troops are positioned.

More improved protective covers, such as concealed type covers (blindages and shelters), which are constructed by the troop during a prolonged stay in positions or in areas of disposition are not under consideration here.

A recess is a hollow in the slope of a foxhole or trench which has the following dimensions: 1.0 x 1.0 x 1.0 m. A recess can be made larger to provide a rest area for men in a prone position. Usually a recess is made for one or two men, but it may also have a larger capacity - for three or four men.

A recess is so situated that above it is provided a protective layer of earth no smaller than 0.6 meters. The entrance to a recess should face the side opposite the enemy.

In loose and medium soils the walls and ceiling of a recess are covered with boards, poles, a slab and other materials at hand. Large boxes, metal and reinforced concrete pipes, rings and other articles can be employed for covering a recess. In rocky and hard soils recesses are constructed without covering the slopes.

A recess is constructed in loose soils in the following manner: the parapet is cleared away where the future recess will be, and then a hole with the necessary dimensions is dug. After the hole is dug its walls are covered, and a layer (open logs) is placed in berms. Dirt no less than 0.6 m deep is spread above the layer.

In stable soils a recess can be built without removing the surface, that is, by digging under and preserving the protective ground layer.

As protection against the penetration of a shock wave the recess is covered with a wooden shield on the inside of which is attached a wooden or metal handle. The shield is made from two layers of boards, between which tar paper, poncho fabric or other hermetic material is inserted. Above the section of the trench adjoining the recess it is advisable to construct an overhead cover which will protect the recess from napalm or other incendiary agent from falling into it and will reduce the effect of the shock wave on the entrance.

The wooden shield which conceals the recess should be coated with a solution of soil, clay or lime. Such a coating protects the shield from being ignited.

Open slit trenches (Figure 26) are made 1.5 m deep and 2-3 m long depending on how many men will occupy them; this is determined by calculating that for one protected individual in a seated position, 1 running meter is necessary, or for one protected individual in a prone position, 1.5 running meters. Such slit trenches are constructed both adjoining trenches and outside them.

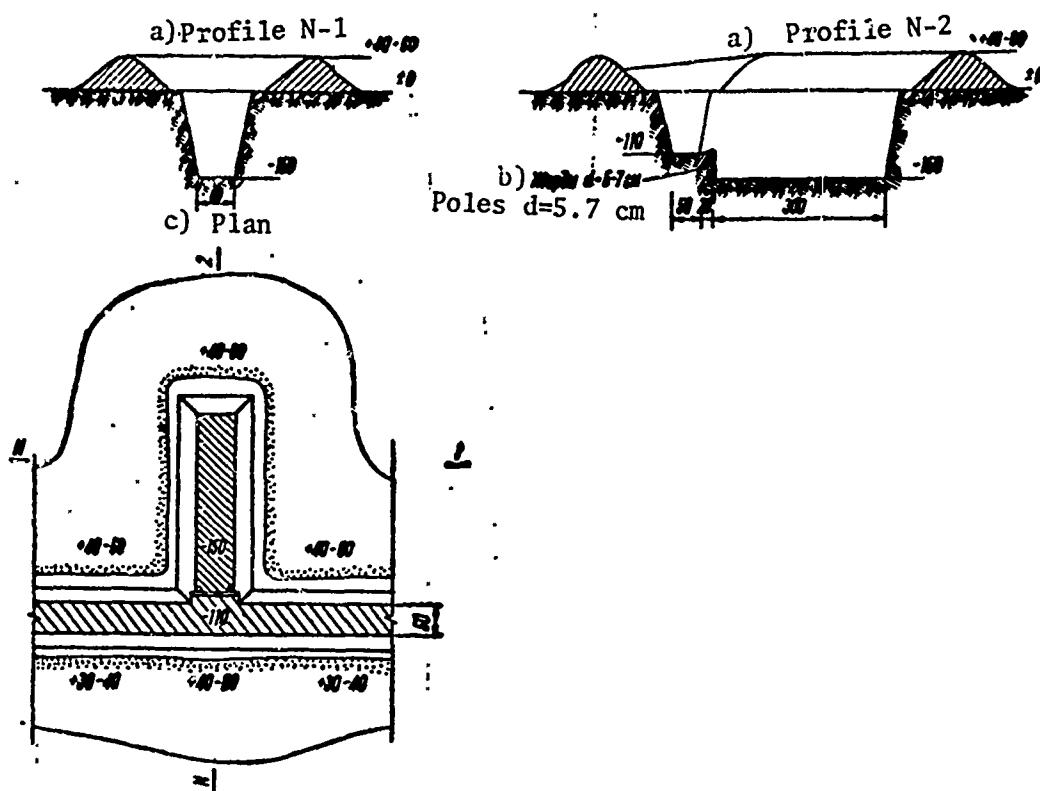


Figure 26
An open slit trench for three men.

If the slit trench is constructed outside the trench dirt steps with coverings to prevent them from collapsing are made to facilitate getting out of it. It is advisable to make the parapet of the slit trenches 0.8-1.0 m high in order to reduce the depth of digging the slit trench to 1.1 m. If there is not enough dirt to build a parapet, it should be taken from the side of the structure.

To make it possible to quickly occupy the slit trench in the event of an atomic explosion it is necessary to place it in immediate proximity to the weapon being serviced or where the personnel are located for a large part of the time.

When time and materials are available a cover made from materials at hand (poles, fascines, brushwood, planks, and so on) together with a layer of earth 30-40 cm thick is constructed above the slit trench (Figure 27). The entrance to the slit trench is concealed by a shield or a mat made from poles, boards or brushwood. The shield is coated with clay, dirt or lime.

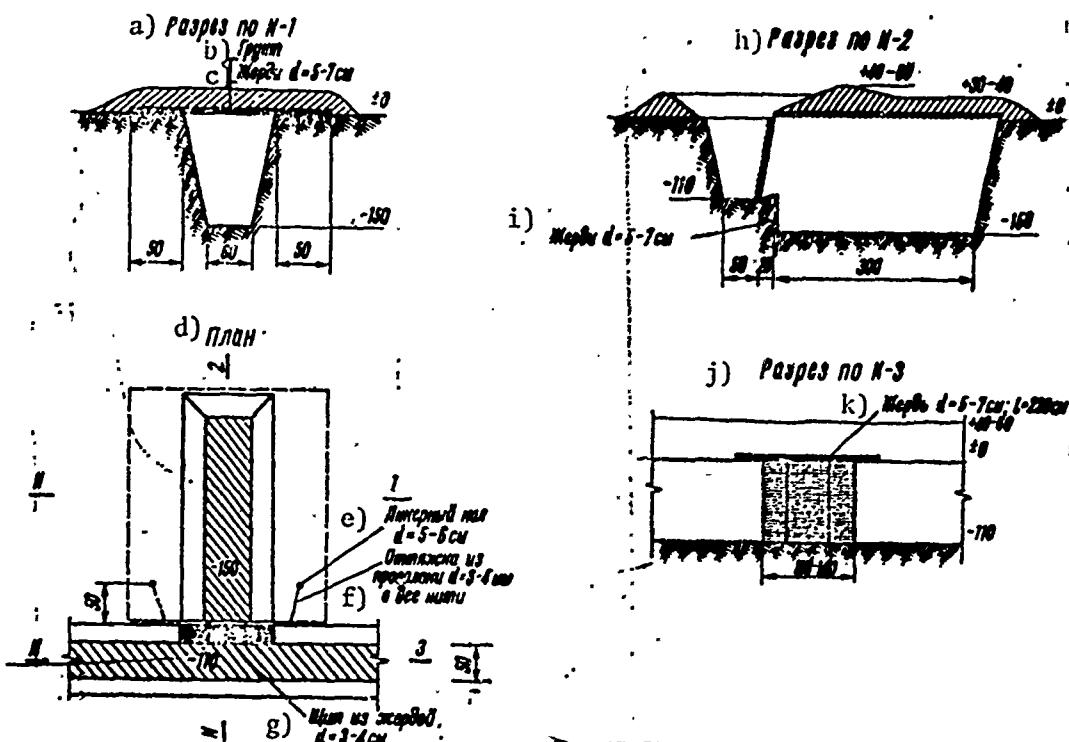


Figure 27
A covered slit trench for three men.

a) Profile N-1; b) earth; c) Poles $d = 5-7$ cm; d) plan; e) anchoring picket $d = 5-6$ cm; f) brace made from wire $d = 3-4$ mm; g) shield made from poles $d = 3-4$ cm; h) Profile N-2; i) poles $d = 5-7$ cm; j) Profile N-3; k) Pole $d = 5-7$ cm.

The covering over a slit trench is laid directly on the ground (without lining). It is also possible to put a cover on the parapet 30-40 cm in height in order to decrease the depth of digging the slit trench and at the same time reduce the amount of work. In this case the internal slopes of the parapets are covered with turf.

The mats which conceal the entrance to the slit trench are made from poles 3-4 cm thick which are bound closely together with wire. For suspending the mats a pole 5-7 cm thick and 220 cm long is attached to its upper part. The pole is fastened to braces made of wire which are secured by anchoring pickets.

When constructing slit trenches in rocky soil (mountainous territory) usually it is possible only partially to deepen them in the soil, and the remaining part is accomplished in the form of high parapets made first from large and then from small bedrocks. To improve the contacts fibrous peat or turf is interlaid between the rocks. From above the parapet is strewn with dirt so that a large number of fragments will not be formed when a bullet hits the bare rocks.

If the rock is monolithic and its upper part does not yield to being developed the slit trench is constructed in the form of a built-up parapet 1.3-1.4 m high.

When time and materials are available in mountainous terrain slit trenches with overhead covers are constructed whose entrances are concealed by shields (Figure 28).

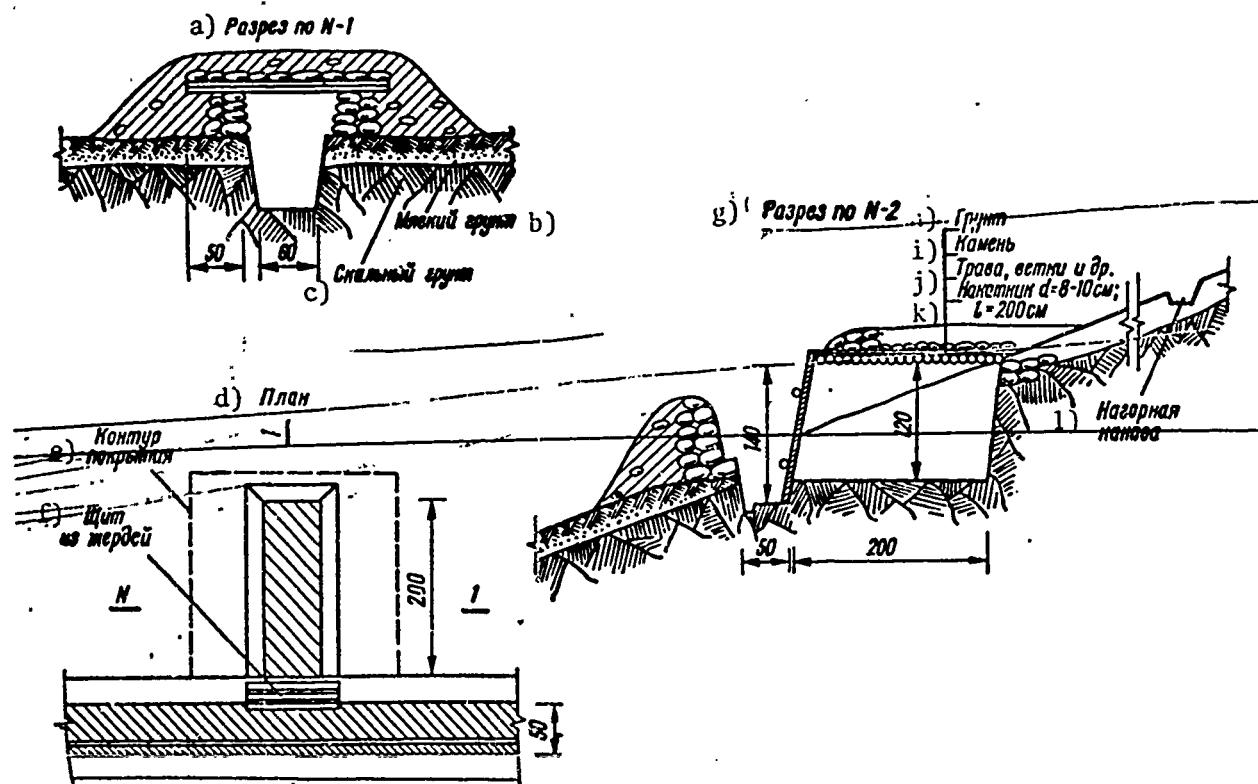


Figure 28

A slit trench with overhead cover in mountainous terrain

a) Profile N-1; b) soft earth; c) rocky earth; d) plan; e) outline of cover; f) shield made from poles; g) Profile N-2; h) earth; i) rock; j) grass, branches and others; k) layer of logs $d = 8-10$ cm; l = 200 cm; l) mountain ditch.

The sections of trenches and communication trenches having overhead cover serve as protection against small fragments of shells and grenades, and also they protect against drop-forming war gas and incendiary agents. The overhead covered sections are usually made 3-4 m long. The construction of a cover for a trench section does not differ from the construction of a slit trench cover. The ditch of overhead covered sections of a trench or of a communication trench is deepened to 1.5-1.8 m.

The skillful adaptation of defensive structures to the terrain makes them much less noticeable and greatly facilitates the concealing features of the terrain, and also the conditions of organic disability (night, fog, bad weather), are some of the natural conditions which are used by the troops to camouflage themselves and the installations. The concealing features of the terrain, that is, the natural cover, helps to conceal an installation, and the landscape features of the terrain (color, texture and design of the ground surface) helps to lessen the visibility of the installation.

The following are classed as natural cover: woods, gardens, parks, high shrubbery, ravines, ditches, shell holes, structures and others. The listed types of natural cover can provide concealment from air visual observation, from all types of photography, from radar, and also from observation using infrared equipment and from ground observation.

Every soldier, sergeant and officer must know how to use intelligently the concealing features of the terrain. When ditches, shell holes, rock fences, demolished buildings and other structures are used as cover a position must be taken up in them on the shaded side. Branches, grass and also ponchos serve as the simplest camouflage facilities (Figure 29).

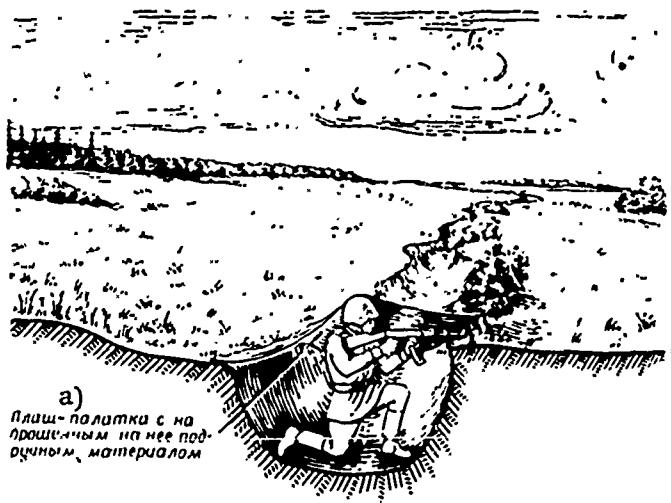


Figure 29

Camouflaging by means of a poncho when located in a ravine or in a shell hole.
a) a poncho with material at hand thrown on it.

Camouflage in a forest and in bushes is facilitated by the fact that trees and bushes are natural cover.

It is necessary to choose a forest with underbrush for the disposition of troops. In a sparse forest it is advantageous to be located at the base of a tree, behind its trunk, beside mounds, stumps, in clumps of undergrowth. It is necessary to utilize the shadow of terrain features for concealing the location (Figure 30).



Figure 30
Making use of a tree's shadow for camouflaging a rifleman.

There are enough places for concealing and camouflaging troops in both demolished population points and those which are not. Above all it is necessary to utilize fences, poles, long obstacles and so on. Heaps of ruins and fences can serve as concealed fire positions (Figure 31).

In mountainous terrain it is easy to camouflage between cliffs, stones and narrow crevices. When moving about it is necessary to keep to the shade side and not come out on the crest of the elevation.

The adaptation of the troops and their combat equipment to the terrain acquires special significance under the conditions of level terrain and the absence of woods and other natural cover.

Dark patches on the terrain are the most favorable for the disposition of personnel and equipment. However, the equipment should be so placed that the personnel, weapons and their shadows are located on a dark patch. With such a disposition the air reconnaissance will not see the shadows revealing the combat equipment.

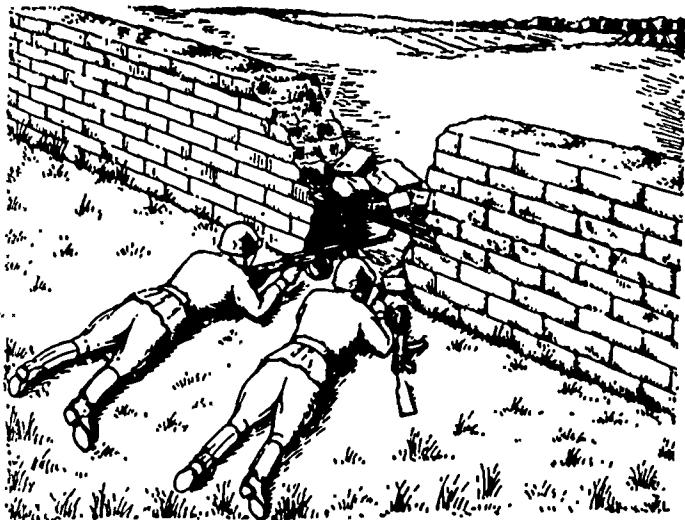


Figure 31
Using the ruins of a building for camouflage.

A machine gun crew and machine gun which are so located without additional camouflage are not visible from an altitude of 200-300 m.

The visibility of tracks and traces is decreased when they are placed along the borders of patches having a marked contrast between themselves (along various obstacles, ditches and so on). The disposition of camouflaged installations in the shadow of terrain features also sharply decreases their visibility.

The presence of bare earth around and on defensive fortifications, decamouflaging them, is a characteristic feature of summer. This decamouflaging sign is eliminated by the disposition of the fortifications on light patches of terrain. Furthermore, the visibility of a fortification is decreased by changing geometrically the regular outlines of parapets and dustings. An especially great camouflage effect is achieved when there are analogous natural patches present on the surrounding terrain.

The simplest covers (slit trenches and recesses) are camouflaged with means at hand: grass, branches, turf, underbrush and so on. Thus, branches, grass, moss and so forth are spread on bare earth. The ditch of a slit trench is camouflaged with various overhead covers which are made up of a frame and camouflaging materials. Mats made from straw, branches, reeds and others may be employed as camouflage material. Mats are convenient camouflage since they can be prepared in the rear, wound into rolls, attached to covers and quickly unwound (Figure 32). In order to prevent mats from catching fire they are covered with clay, dirt or a lime solution.

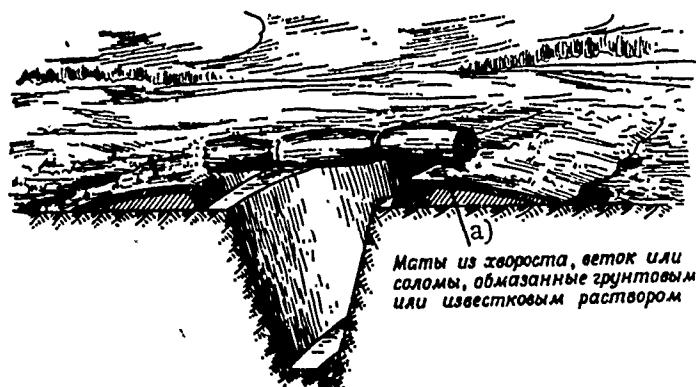


Figure 32

The camouflaging of a slit trench using flat camouflage-overhead covers.

a) mats made from underbrush, branches or straw, covered with a dirt or lime solution.

CHAPTER 3

Trenches for Tanks and Artillery

Trenches for tanks and artillery are constructed in order to provide them with the conditions for the successful accomplishment of fire missions, and also to increase the defense of crews and equipment from the effect of modern means of destruction. Furthermore, when tanks and artillery are located in trenches better conditions are created for their camouflaging in imitation of the background of the surrounding terrain by using the organic camouflage covers and improvised camouflaging means.

The trench consists of an emplacement for conducting fire, concealment for the crew, ramps for entering (exiting) of combat equipment and a parapet. Furthermore, recesses for ammunition are set up in trenches for artillery.

The mutual disposition of all elements of the trench can be varied and depend on the assigned fire mission and the character of the terrain.

Depending on the assigned mission and the conditions of the terrain the trenches are constructed with a limited sector of field of fire (from 60-120°) or with a circular field of fire (360°). For tanks, for example, trenches are constructed with a narrow sector of fire since in broken terrain it is practically impossible to select the kind of position which will permit circular fire. In trenches for self propelled artillery pieces the sector of fire is established depending on the dimensions of the horizontal angle of traverse of the combat vehicle's turret.

For pieces assigned to conduct fire from concealed firing positions or direct laying for destroying some kind of known targets, trenches with a limited sector of fire are constructed. If the pieces should fire on tanks or other moving targets of the enemy and the direction of their approach to position cannot be determined earlier, trenches with circular fire are constructed for such pieces.

When the time, forces and means are available, it is advisable to construct a trench with a limited sector of fire, and next to it an emplacement permitting circular fire to be conducted.

It is necessary to keep in mind that a trench with a limited sector of fire provides the best defense of the piece and crew from the effect of modern means of destruction since its depth makes possible the concealment of the cannon to the top of the shield assembly. Such a trench serves as concealment for the piece at the same time.

The decision on the kind of trenches to construct for firing positions with a limited sector of fire or with a circular field of fire, should be made by the commanders of the podrazdelenie after they have studied the combat mission and surveyed the terrain on which the fire position is to be located.

A more reliable defense for tanks, self-propelled mountings and pieces against their destruction by atomic explosion is achieved by constructing along with the trench a covered position in which the combat equipment can be concealed during breaks in the fulfillment of combat missions.

It must be observed that certain of the trenches for pieces and mortars existing until the present time have serious shortcomings, the chief of which is the curvilinear contour of the emplacements in the plan, which makes difficult and sometimes even excludes the possibility of utilizing mechanized means for constructing these trenches. Furthermore, the existing types of trenches make difficult the mounting of pieces and mortars with the aid of prime movers in them. The manual mounting of the pieces, especially large caliber, by the crews is difficult or even practically impossible, especially in loose soils.

It should be mentioned that a right angle form in the plan is characteristic for the majority of modern trenches, which during their digging provide the most effective utilization of mechanized facilities, especially mounted bulldozer equipment on artillery prime movers and tanks.

It is recommended that all trenches be constructed with raised parapets (1.0-1.5 m) which significantly decreases the volume of earth work performed during the digging of trenches and increases their protective features.

Furthermore, the right angle form of the trenches in the plan makes discovery by the enemy reconnaissance difficult and facilitates their camouflage.

We shall make a more detailed study of the construction of the most widespread trenches for tanks, self-propelled mountings, pieces and mortars.

Trenches with a limited sector of fire for tanks and self-propelled mountings (Figures 33, 34) consist of an excavation, a ramp and a parapet. The width of a trench for a tank (self-propelled artillery mounting) along the bottom is fixed by its width measured between the outer edges of the caterpillar track plus an additional 20-25 cm on each side. The width of the trench along the top is equal to the width along the bottom of the trench, increased by two gradients of slope of the ditch walls. To provide the firmness of the side slopes against a collapse caused by the effect of a shock wave their steepness conforms to the limits of 5:1-3:1, and in loose (open unstable) soils 3:1 and more sloping. The relationship of the ditches' depth (the height of the embankment) to the gradient of the slope is called the steepness of the side slopes. This is not hard to understand if one imagines a right triangle where the greater leg is the depth of the ditch and the lesser leg is the gradient of the slope, and the hypotenuse is the steepness of the ditch wall (embankment). The data given above, 5:1 and 3:1, indicate that the ditch depth is five (three) times greater than the gradient.

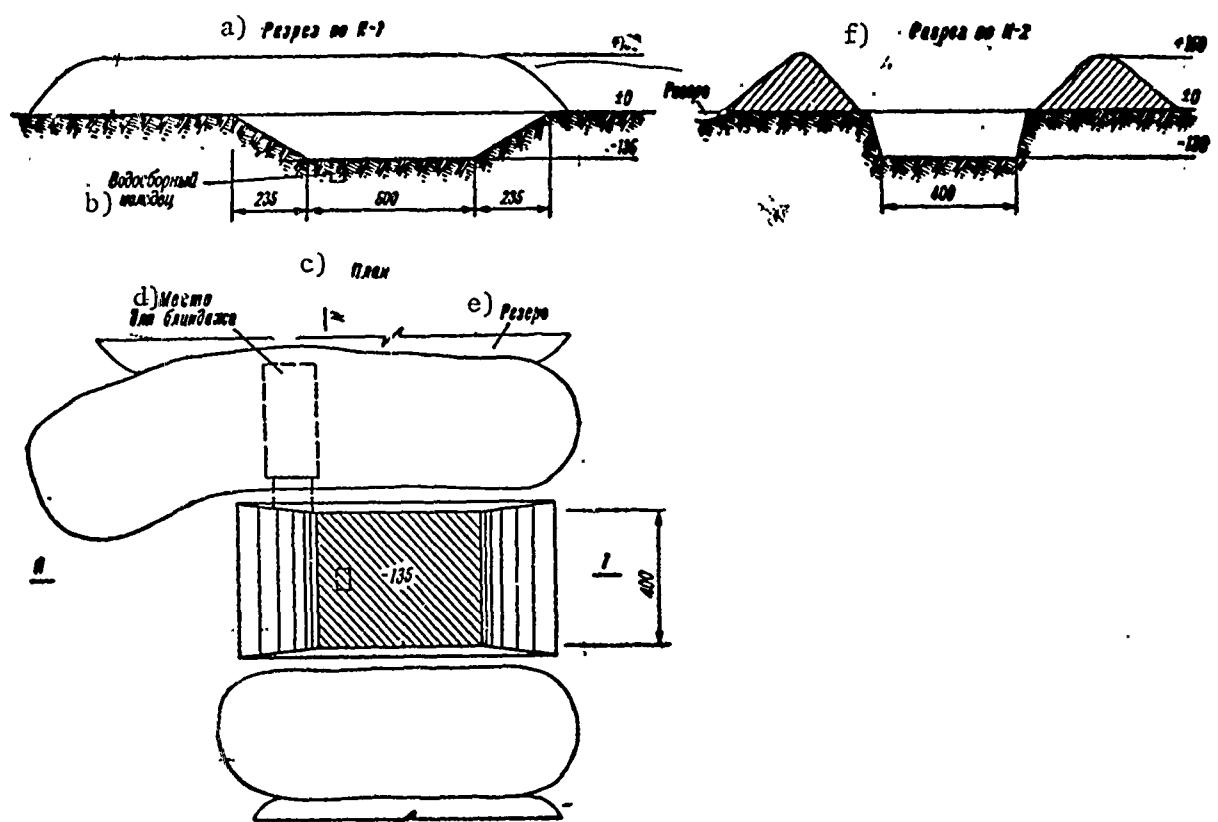


Figure 33

A trench for a tank

The volume of dirt removed is 50 m^3 . Required for construction: 65 manhours when dug by hand; 1.2 machine hours and 10 manhours when dug mechanically.

a) profile N-1; b) water collection well; c) plan; d) space for a blindage; e) plan; e) reserve; f) profile N-2.

The length of the trench bottom usually should equal the length of the combat vehicle decreased by 50 cm. The depth of the trench ditch depends on the character of the terrain where the trench is located and the disposition height of the piece barrel above the surface of the earth. Thus, for example, when the trench is located on level terrain the depth of the trench ditch is assumed to equal 50-60 cm. The overall height of the trench cover (the depth of the trench ditch plus the height of the parapet) usually equals the height of a tank or a self-propelled artillery mounting. The height of the trench parapet, as a rule, equals 1.0-1.5 m. Such a trench simultaneously serves also as cover.

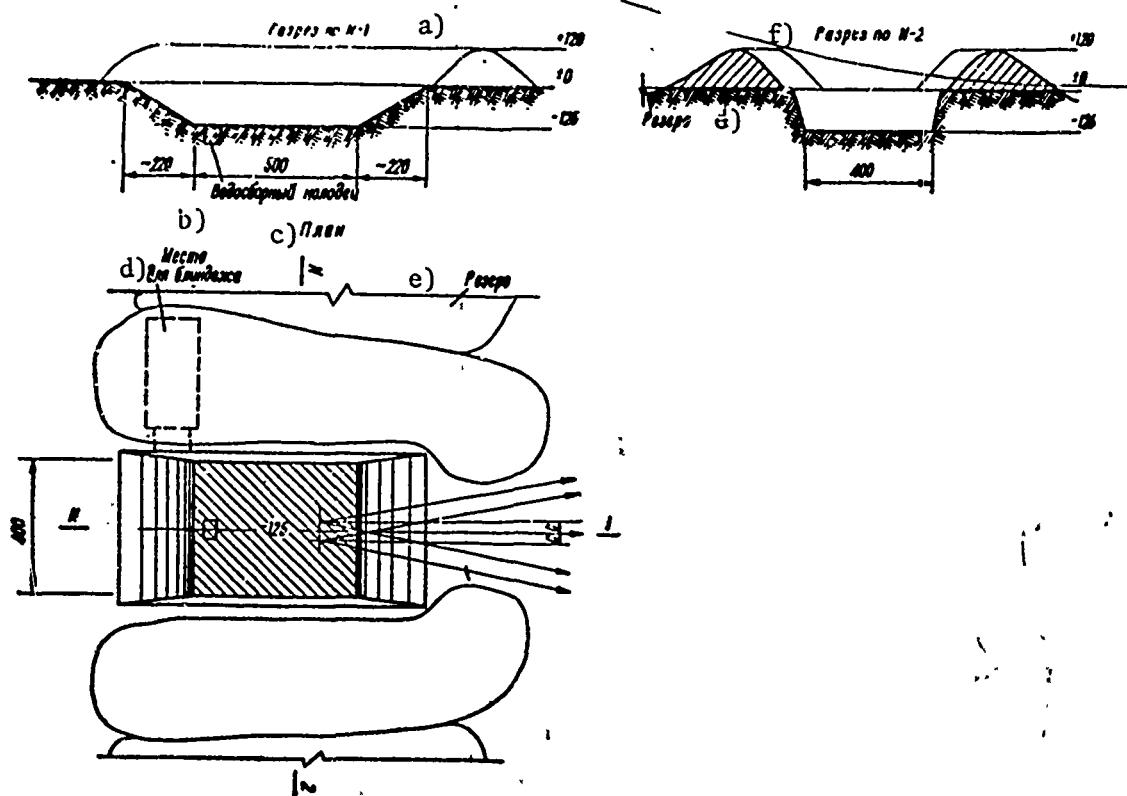


Figure 34

A trench for a self-propelled artillery mounting
 The volume of dirt removed is 40 m^3 . Required for construction:
 54 manhours when dug by hand; 1.0 machine hours and 10 manhours
 when dug mechanically.

a) profile N-1; b) water collection well; c) plan; d) space
 for blindage; e) reserve; f) profile N-2.

The incline of the ramp (the sloping entrance to the trench is
 called a ramp) depends on the quality of the soil and is taken to equal
 $1:3-1:4$. In loose and unstable soils a track cover made from logs, fas-
 cine or underbrush is laid along the ramp and trench bottom.

Slit trenches or blindages are constructed to protect the crews,
 which are usually situated on the side or in the bottom of the trench, and
 also in direct proximity to it at a distance of not more than 30-40 m.

When it is necessary to have a circular field of fire the trench
 is constructed as shown in Figure 35.

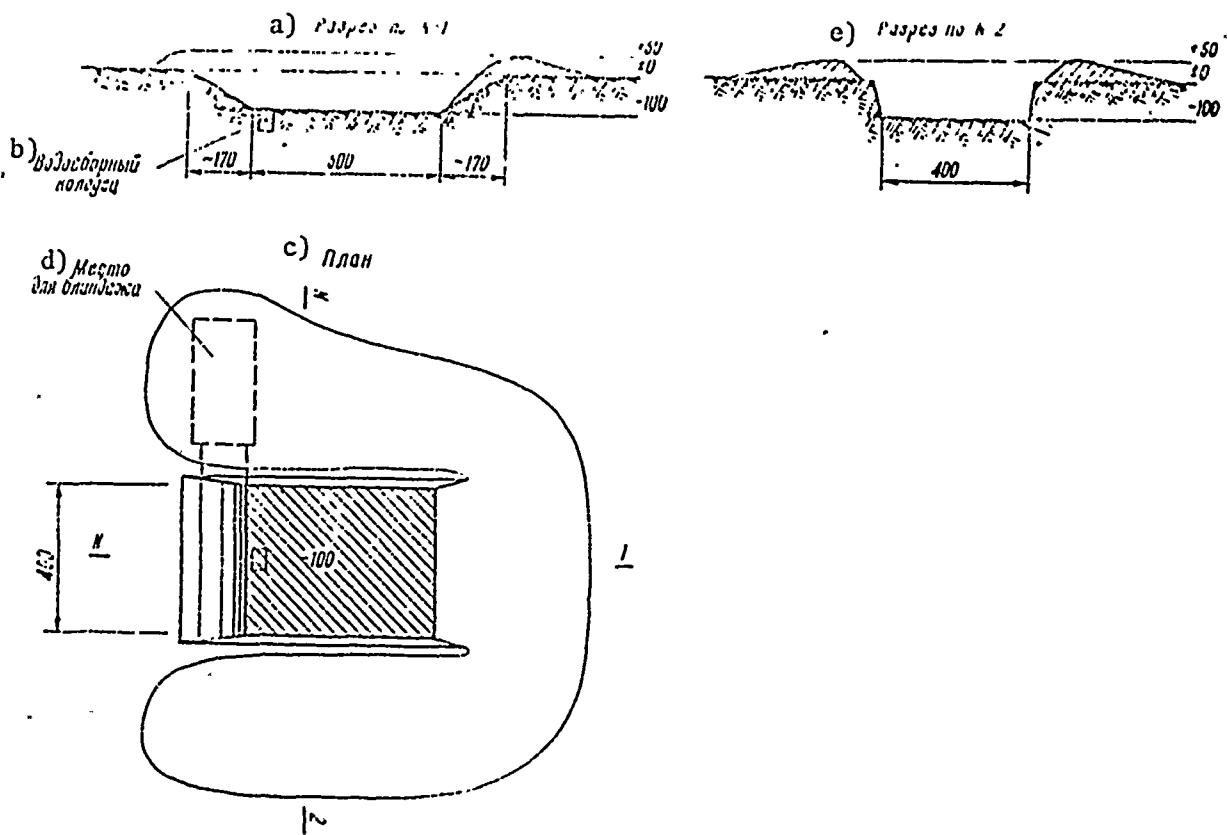


Figure 35
 A trench for a tank with a circular field of fire.
 a) profile N-1; b) water collection well; c) plan; d) space for blindage; e) profile N-2

In areas of troop concentration and disposition when it is not necessary to lay down fire, covered positions are constructed for materials supplies. In this case for the protection of crews open and covered slit trenches for one or two crews or one shelter for a tank or self-propelled artillery mounting platoon.

Trenches for anti-tank artillery are primarily constructed with a limited sector of fire ($60-120^\circ$) in order to better protect the piece and crew. If it is necessary that the piece lay down a circular field of fire it is hauled out of the trench and set up in a previously prepared emplacement. A trench for anti-tank artillery (Figure 36) consists of an emplacement for the piece, a ramp, two recesses for ammunition and a concealed cover for the crew. The trench parapet usually is 60-90 cm in height. It should be borne in mind, that in constructing a trench in a system of trenches the height of the trench parapet should be no higher than 20-30 cm more than the parapet of the trench system (from the condition of camouflage).

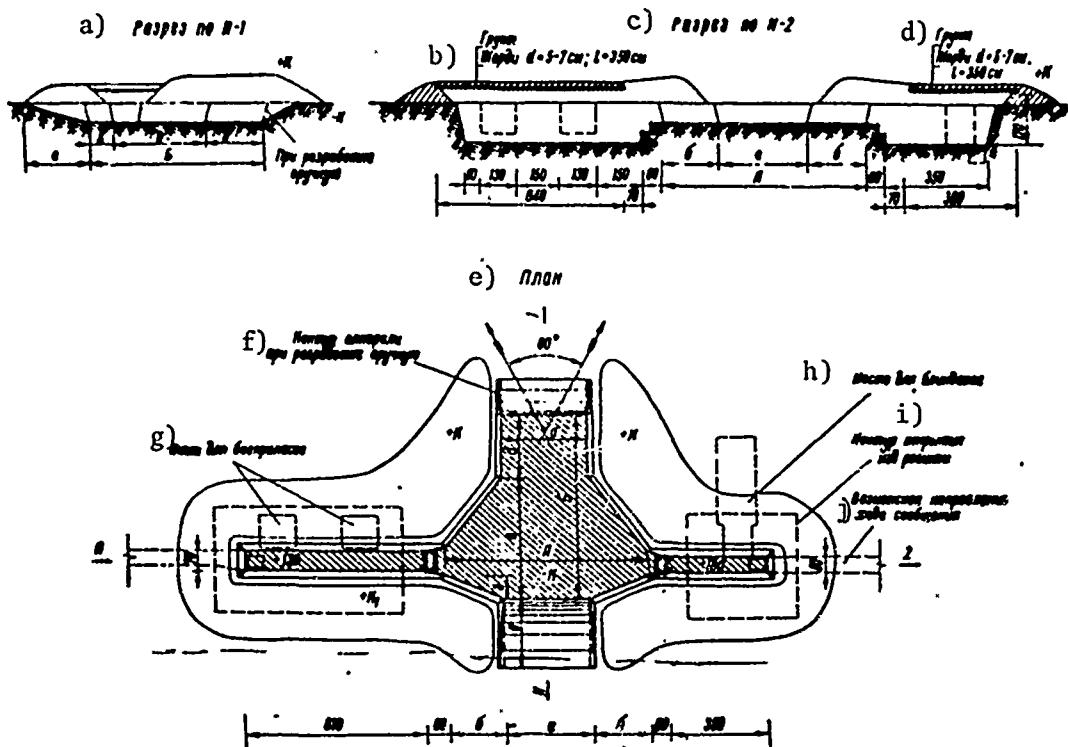


Figure 36

A trench for an anti-tank artillery with a limited sector of fire ($60-120^\circ$).

The volume of dirt removed is 35-40 m³. Required for construction: 55-60 manhours when dug by hand;
(remaining caption illegible)

- a) profile N-1; b) dirt poles; c) profile N-2; d) dirt poles;
- e) plan; f) design of ramp when hand-dug; g) recesses for ammunition; h) space for blindage; i) contour of cover over latrine; j) possible direction of communication trench.

The recesses for ammunition supplies are built in a specially dug out slit trench where they are cut into its forward slope. Furthermore, it is advisable to make a platform in the trench on which shells are laid ready for firing.

To protect the crew first of all an open slit trench is constructed which is situated on the opposite side of the slit trench with the recesses.

If time and materials permit a protective cover is constructed above the slit trench for the crew and above the recesses for the ammunition. Furthermore, a blindage is constructed for a more reliable protection of the crew, and it is usually placed adjacent to the slit trench.

The dimensions of the trench elements for a 57-mm and an 85-mm gun are given below in the table.

Designation of guns	Dimensions, cm (see Figure 36)										
	A	B	a	b	v	g	d	e	-K	+K	+K ₁
57-mm gun	450	450	250	100	250	70	200	190	50	80	60
85-mm gun	700	600	300	200	400	85	200	230	60	90	60

If the terrain features are favorable for the conduct of fire trenches for anti-tank guns can be built with a circular field of fire (Figure 37).

The dimensions of elements of trenches having a circular field of fire for the 57-mm and the 85-mm guns are given below in the table.

Name of guns	Dimensions, cm (see Figure 37)									
	D	a	b	v	g	d	e	-K	+K	
57-mm gun	800	250	300	350	150	350	100	80	60	
85-mm gun	1000	250	380	450	200	450	100	100	60	

A trench for a recoilless weapon is shown in Figure 38. Such a trench is constructed without a parapet both in the sector of fire and on the opposite side. The trench consists of an emplacement for the weapon, a ramp designated for mounting the weapon and the removal of a stream of gases during firing, and also a communication trench adjoining the sectors in which are located recesses for shells and protective cover for the crew.

The dimensions for trench elements for the 82-mm and 107-mm recoilless weapons are given below in the table.

Caliber of weapon	Dimensions, cm (see Figure 38)						
	a	b	v	g	d	-K	+K
82-mm	170	240	-	225	120	60	60
107-mm	320	390	200	390	220	100	60

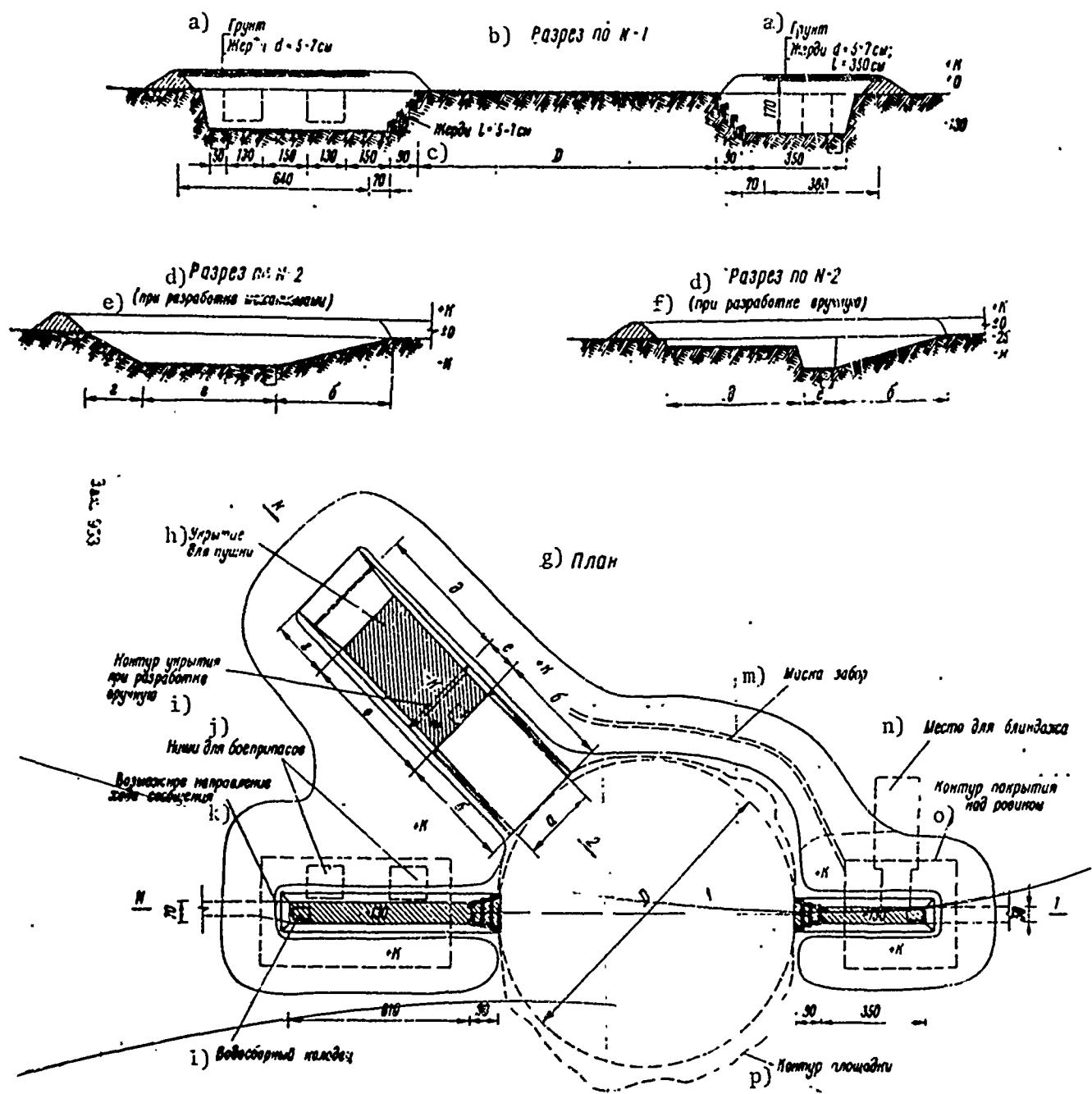


Figure 37

A trench for an anti-tank artillery piece with a circular field of fire. The volume of excavated dirt is 30 m^3 . Required for construction: 50 man-hours when dug by hand; 0.5 machine hours and 15 manhours when dug mechanically.

a) dirt poles; b) profile N-1; c) poles; d) profile N-2; e) mechanical excavation; f) manual excavation; g) plan; h) cover for gun; i) outline of cover when manually excavated; j) recesses for ammunition; k) possible direction of communication trench; l) water accumulation well; m) cover fence; n) space for blindage; o) outline of cover above slit trench; p) outline of emplacement.

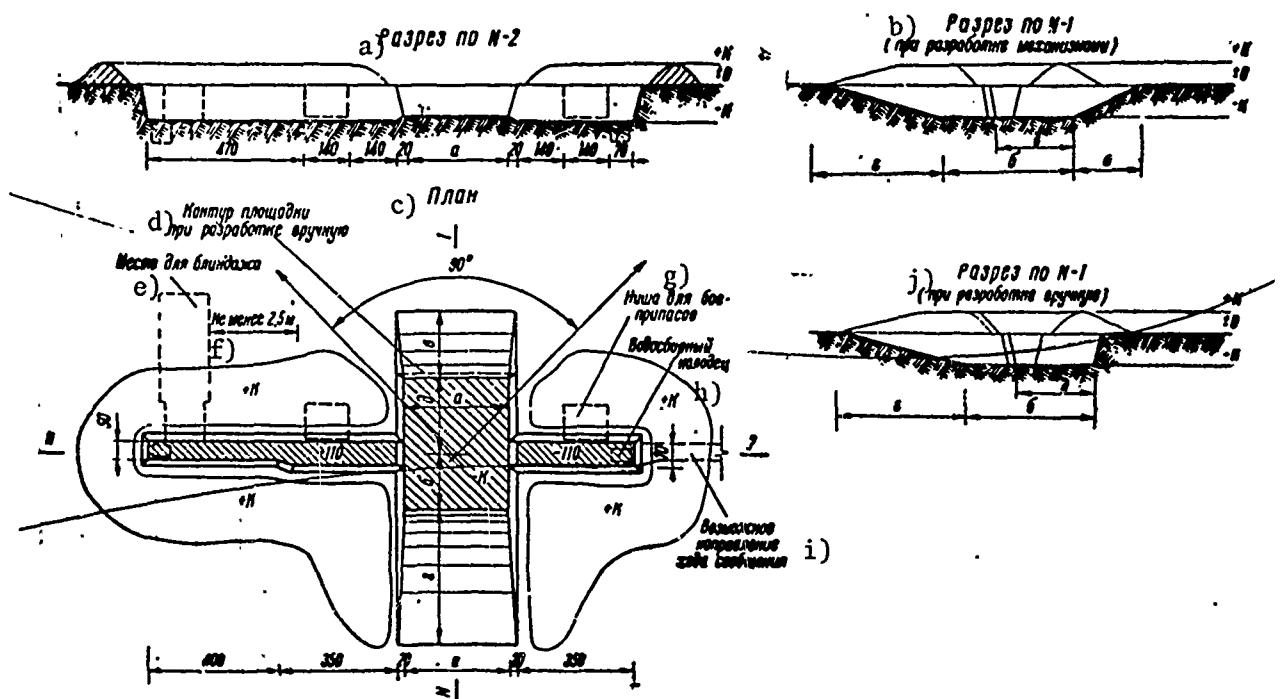


Figure 38

A trench for a recoilless weapon.

- a) profile N-2;
- b) profile N-1, (when excavated mechanically);
- c) plan;
- d) outline of emplacement when manually excavated;
- e) space for blindage;
- f) no less than 2.5 m;
- g) recess for ammunition;
- h) water accumulation well;
- i) possible direction of communication trench;
- j) profile N-1 (when excavated manually).

Trenches for howitzer and gun artillery are constructed, as a rule, with a limited sector of fire for firing from concealed positions, since these weapons seldom participate in the laying down of direct fire attacks.

Weapons of 122-mm - 152-mm caliber, as is well known, are very heavy and therefore mounting and rolling them out of a trench is a difficult task for the crew to perform manually. In connection with this, the contour of the trench should be such that it will provide for the mounting of the weapons into the trench and its exit from the trench with the help of a prime mover. Furthermore, the contour of the trenches in the plan should be rectilinear which makes it possible to excavate them using a truck mounted bulldozer of the artillery prime movers.

The trenches for the 122-mm and the 152-mm weapons are constructed with a deepened emplacement for the weapon (Figure 39), and as a result they at the same time serve as protective cover for the crews and equipment.

Such a trench consists of an emplacement for the weapon, recesses for ammunition and a ramp for rolling in (rolling out) the weapon. The trench dimensions for the 122-mm howitzer and the 152-mm gun are given below in the table.

Name of Weapon	Dimensions, cm (see Figure 39)													
	A	B	a	b	v	g	d	e	zh	z	vg	-K	+K	
122-mm howitzer	800	550	400	200	370	60	330	160	-	200	250	250	100	90
152-mm gun	1200	750	600	300	370	120	450	180	-	210	300	300	100	90

For laying down direct fire the trenches for the weapons are constructed with a parapet permitting a field of fire in the sector of up to 60°.

Recesses for ammunition are organized on the left side of the trench emplacement in the open and covered section of the communication trench. For protecting charges and shells, in addition, recesses are built adjacent to the weapon emplacement.

A slit trench or blindage is constructed by every trench to protect the crew, and a shelter of the light type is constructed for the fire platoon.

In loose soils the trench slopes are covered with poles, underbrush and other materials at hand, and tracks made from logs or poles are built on the ramps.

To increase the stability of the weapon during firing, especially if the trench is constructed in loose soil, a flooring made from framed logs, held together by brackets, is laid down under the wheels of the weapon flush with the surface of the emplacement.

To reduce the dust formed during firing the surface of the parapet in the blast area is covered with turf which is secured to the earth by wood pegs, or the parapet is covered with poles, netting, mats made from underbrush or metal grids. For firing with large angles of elevation, a depression is dug out in the gun emplacement into which the breech end of the barrel is rolled.

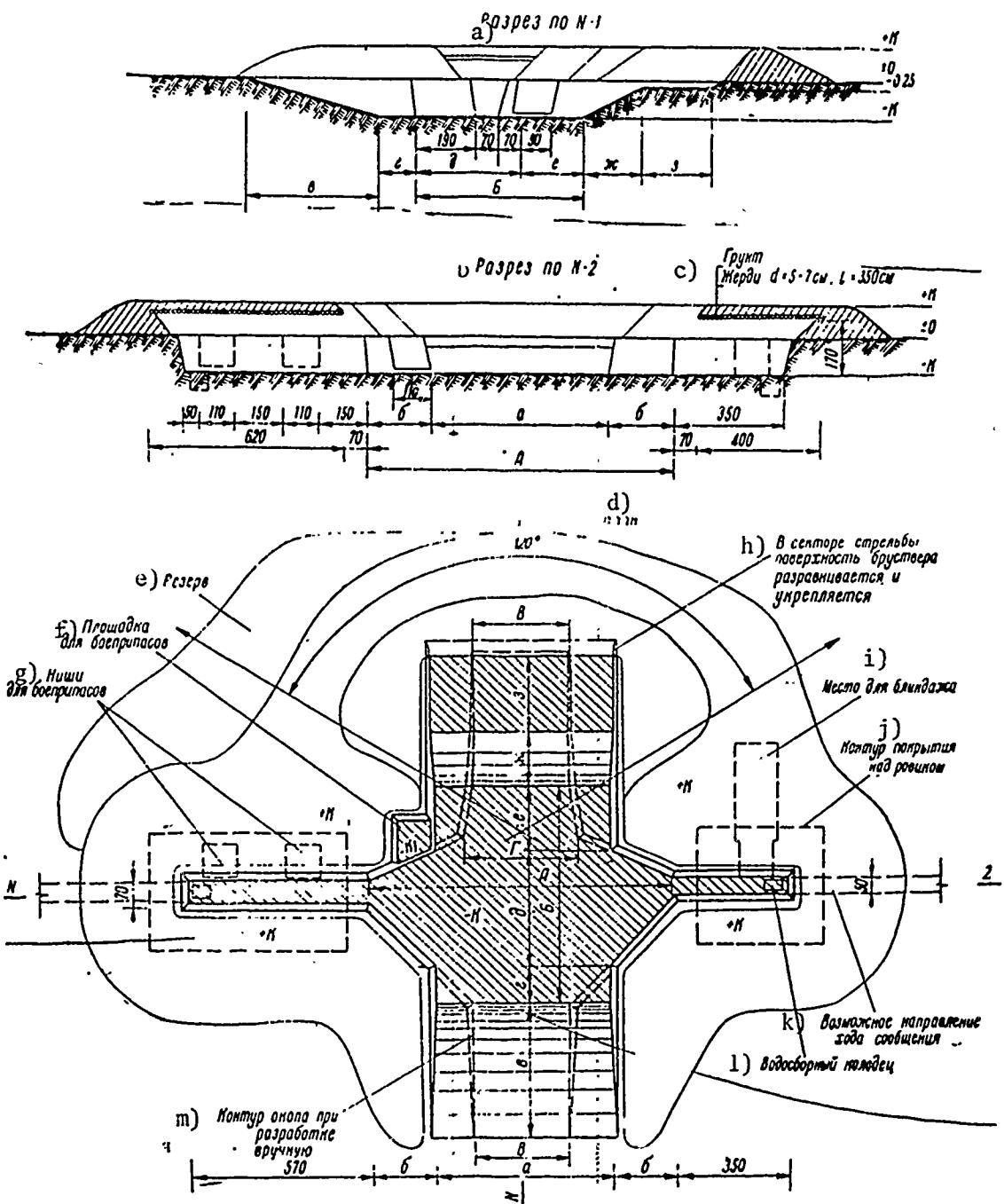


Figure 39

Trench for 122-mm, 152-mm weapons with a 120° sector of fire.
 The volume of dirt excavated is 85.0 m^3 . Required for construction: 120 man-hours when manually excavated; 1.4 machine hours and 50 manhours when mechanically excavated.

- a) profile N-1; b) profile N-2; c) dirt, holes; d) plan; e) reserve;
- f) platform for ammunition; g) recesses for ammunition; h) in the sector of fire the surface of the parapet is leveled out and packed down; i) space for a blindage; j) contour of cover above slit trench; k) possible direction of communication trench; l) water accumulation well; m) contour of trench when $d = 5-7\text{cm}$, $l = 350\text{cm}$; excavated manually.

Trenches for the combat vehicles of the rocket-launching artillery have several characteristics conditioned by the possibility that the slopes and ramp can be destroyed by the jet of rocket gases formed during firing. The trench includes the following elements: an emplacement for the combat vehicle and a ramp (Figure 40); a protective cover for the crew is sometimes constructed.

a) *slan*

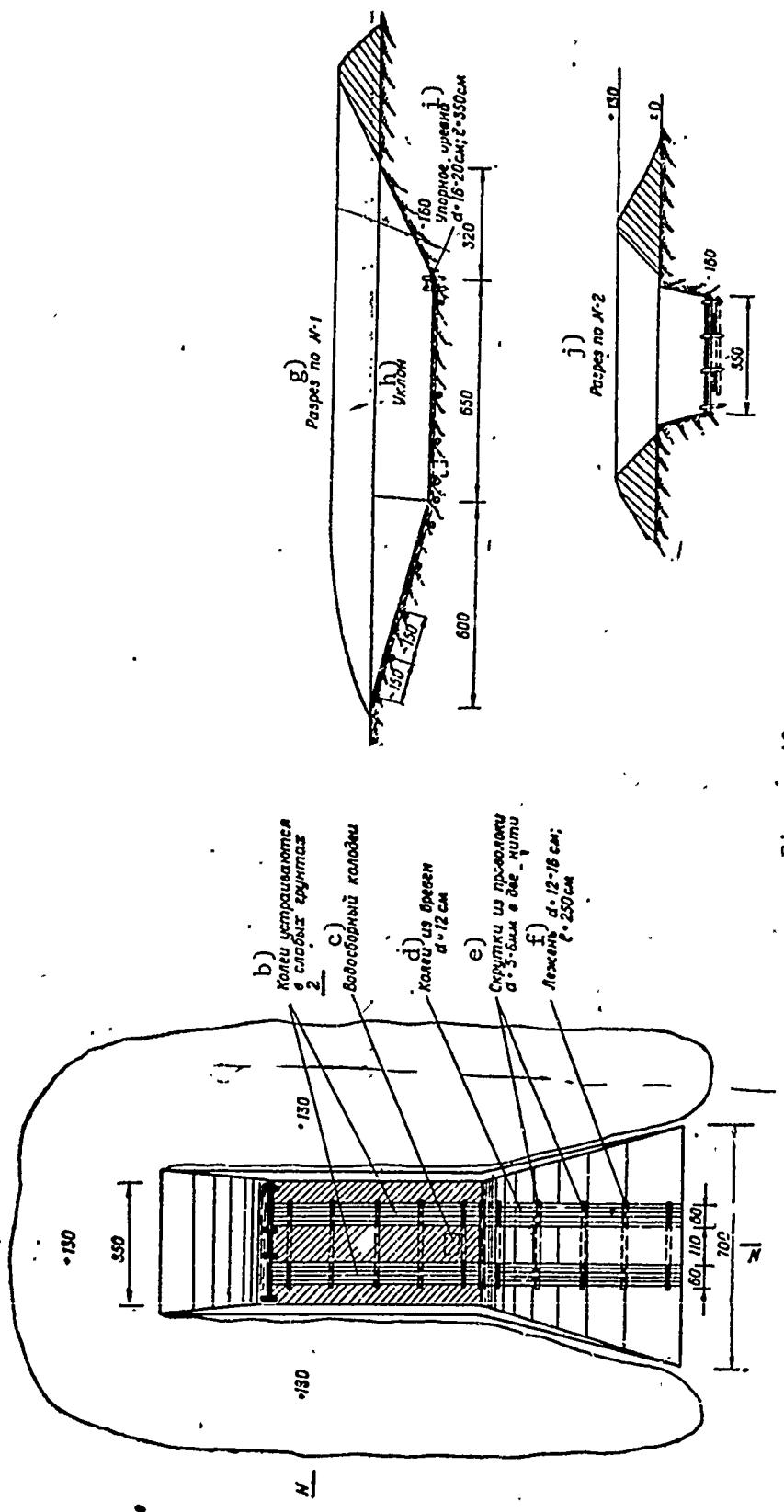


Figure 40

The volume of dirt excavated is 75.0 m^3 . Required for construction: 1.5 machine hours and 40 manhours.
 a) plan; b) a track is laid in loose soils 2; c) water accumulating well; d) track made from logs, $d=12 \text{ cm}$;
 e) twist joints made from wire, $d=5.6 \text{ mm}$ in two strands; f) tie, $d=12-16 \text{ cm}$; l = 250 cm; g) profile N-1;
 h) gradient; i) support log, $d=16-20 \text{ cm}$; l = 350 cm; j) profile N-2.

The depth of the trench (taking into account the height of the parapet) is determined by the necessity to completely conceal the military vehicle with lowered launching rails. In the forward part of the trench 50 cm away from the wall a log support is made so that in case of a starter failure the engine can be started by the crank handle. The ramp is made gradually wider toward the top in order to insure the free exhaust of gases during firing, during a deflection shift of the combat vehicle by the wheels or during a turn of the launching rail packet. To increase the stability of the combat vehicle during firing the ramp is strengthened by a covering. The ramp is covered with logs 12 cm in diameter, laid on lengthwise sleepers and tied to them with wire.

Trenches for 82-mm and 120-mm mortars are constructed with a circular field of fire and a right angle contour in the plan, making possible their excavation by tractor-mounted bulldozer equipment.

A trench for the 82-mm and the 120-mm mortar (Figure 41) has an emplacement 80 cm deep, a ramp, which in the 82-mm mortar trench need not be constructed, two recesses for mortar shells on the right side of the trench and a protective cover for the crew. To secure firing recesses for mortar shells can be dug in the side of the trench.

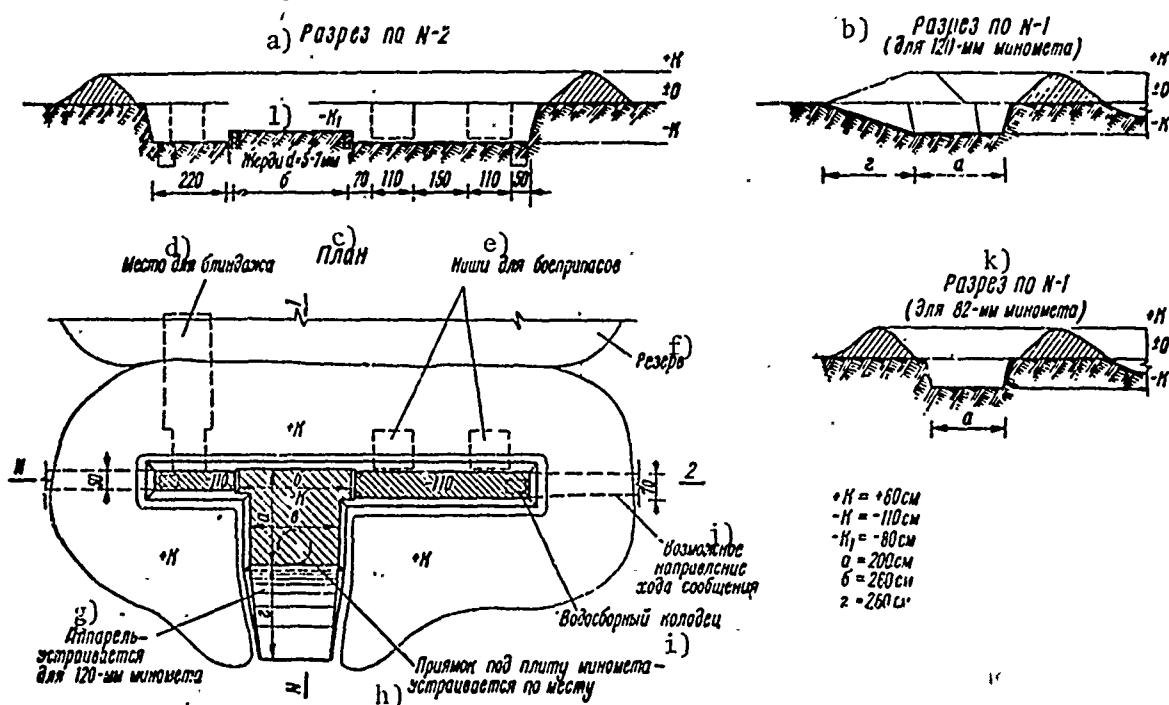


Figure 41
Trench for 82-mm and 120-mm mortars.

The amount of dirt excavated is 15.0 m^3 . 20 manhours are required for construction. a) profile N-2; b) profile N-1 (for 120-mm mortar); c) plan; d) space for blindage; e) recesses for ammunition; f) reserve; g) ramp constructed for 120-mm mortar; h) a pit under the mortar plate is dug according to the area; i) water accumulation well; j) possible direction of communication trench; k) profile N-1 (for the 82-mm mortar); l) poles.

A pit is dug on the emplacement in the trench in which the base plate of the mortar is placed. The accuracy and speed of fire of the mortar depends on the evenness of the plate's lie against the ground and how firmly the spades are attached to the two-legged gun mount. The pit for the base plate is made so that the plate is installed in it at an angle of 20-30° to the surface of the emplacement. The entire surface of the plate must touch the ground. At least 3/4 of the plate's edges should be in the ground. In loose soils the walls of the walls of the pit for the plate are covered with turf, earth filled bags or other material at hand. If the mortar is placed on rocky ground turf, earth filled bags or a layer of loose earth is laid under the base plate, to prevent a deformation of the plate and to prevent the mortar from hopping.

Trenches for 37-mm, 57-mm and 85-mm anti-aircraft artillery are constructed with a circular field of fire.

In addition to conducting fire at aircraft, the weapons of the anti-aircraft artillery fire from the trench at ground targets in some cases. This requirement must be taken into consideration when constructing trenches for anti-aircraft artillery.

Trenches for anti-aircraft artillery of small and medium caliber have an identical outline in the plan, which permits them to be excavated using mechanical facilities. The trench consists of an emplacement for a crew (a covered slit trench or a blindage) (Figure 42). The dimensions of the trench elements for the 37-mm, 57-mm and 85-mm anti-aircraft guns are given below in the table.

Name of weapon	Dimensions, cm (see Figures 42 and 43)						
	a	b	v	g	d	-k	+k
37-mm and 57-mm guns	500	560	150	306	250	40	50
85-mm gun	580	600	260	320	280	70	50

To provide the best defense for the guns the trenches can be constructed with a deepened emplacement and a raised parapet, as shown in Figure 43. In so doing the full elevation of the concealment (the depth of the trench plus the height of the parapet) must equal the height of the gun with the barrel in a horizontal position. If it is necessary to fire at ground targets a dismountable parapet made from earth filled bags is constructed in the probable direction of fire. The slopes of the trench can be covered with poles, netting or other materials at hand, and a flooring made from logs can be laid on the emplacement for the gun and on the ramp.

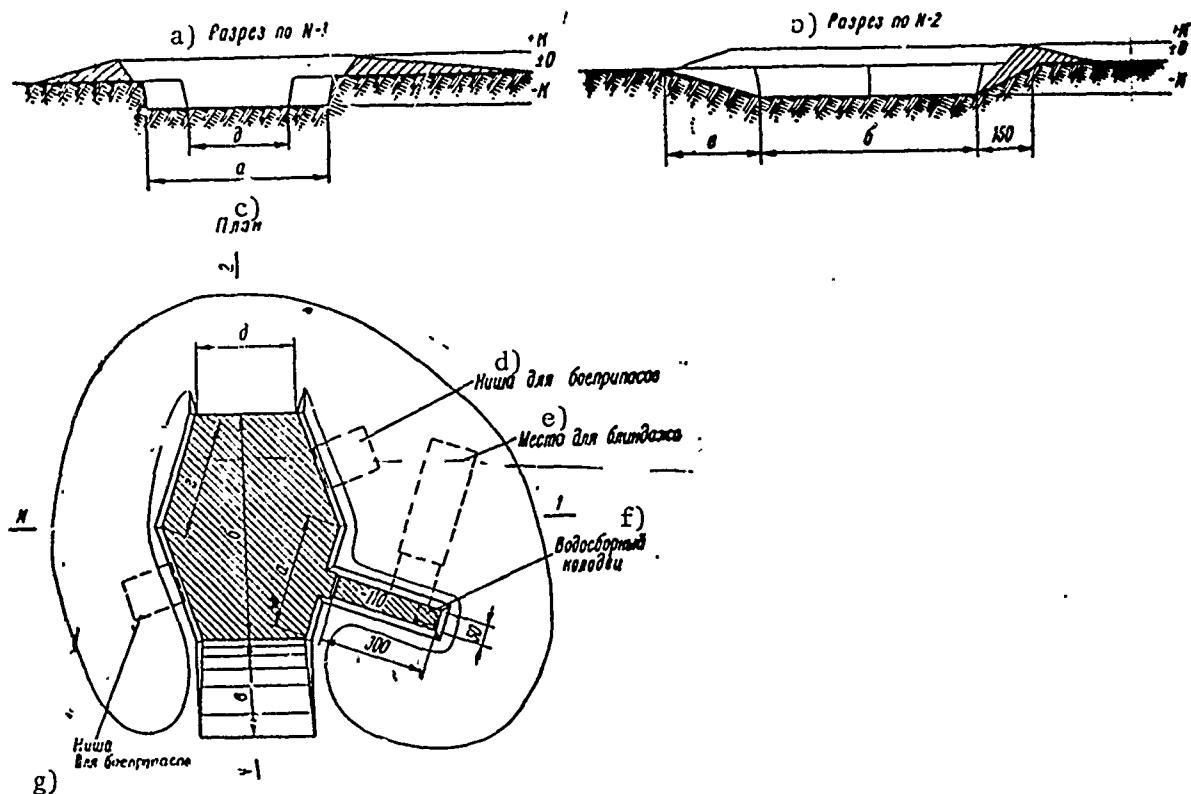


Figure 42

Trench for 37-mm, 57-mm and 85-mm caliber anti-aircraft artillery. The amount of dirt excavated is 15.0 m^3 . 25 manhours are required for construction of the trench. a) profile N-1; b) profile N-2; c) plan; d) recess for ammunition; e) space for blindage; f) water accumulation well; g) recess for ammunition.

Any shells are expended during firing from anti-aircraft guns. Therefore, near the trench several dispersed covered shelters for shells are built. For example, two recesses are constructed on opposite sides of the emplacement, one of them cut into the slope of the trench and one in the communications trench adjoining the trench. Sometimes a small magazine is built in place of a recess. Such positioning of the recess makes it possible to supply shells for any position of the barrel in relation to the trench.

Instead of slit trenches or blindages constructed alongside of each trench, one or two shelters of the smaller type are erected for the battery at the firing position to protect the personnel of the battery.

Covers for ammunition are constructed in the form of recesses. Recesses for ammunition are usually located in the overhead covered sections of the communication trench adjoining the trench or directly in the trenches (for the guns of the anti-aircraft artillery). If at all possible the walls

of the recesses are covered with boards or poles, and an overhead cover made from logs and strewn with dirt is constructed above. The construction of a recess for storing shells is shown in Figure 44.

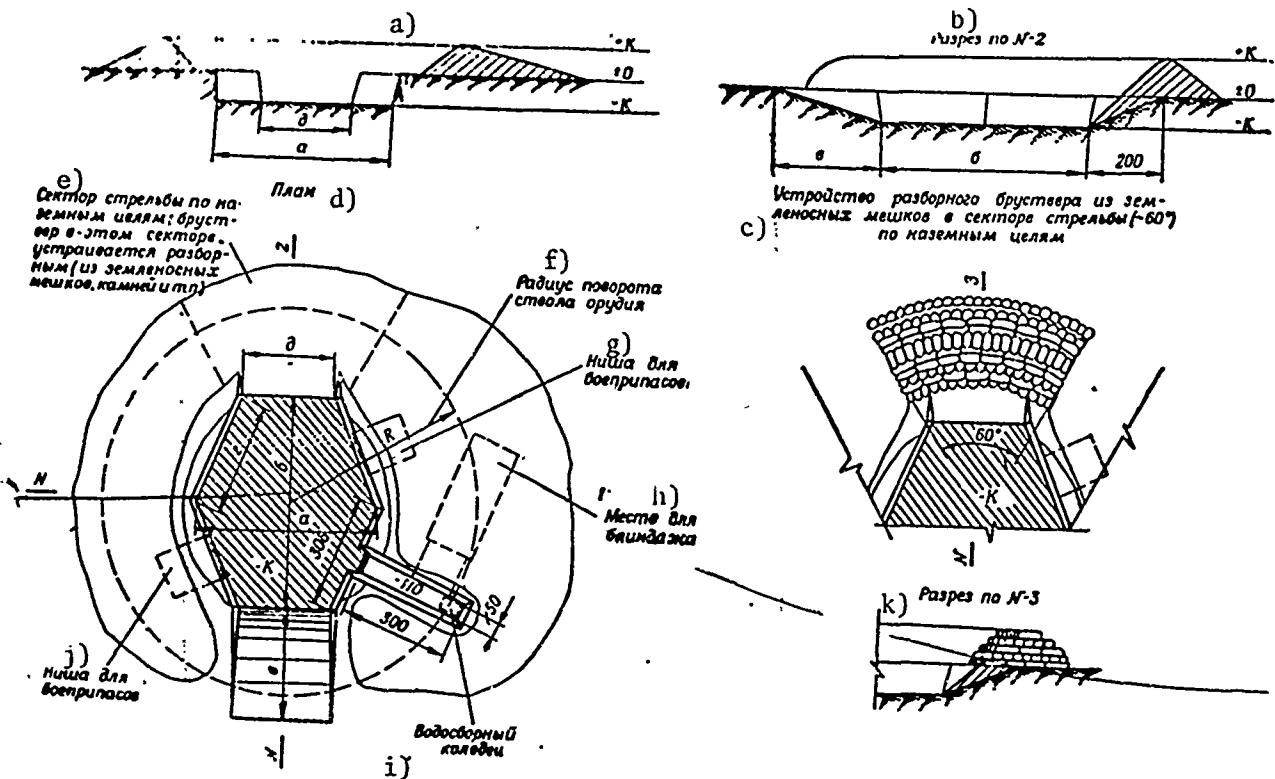


Figure 43
A trench for anti-aircraft artillery with a dismountable section of parapet made from earth filled bags.

a) profile N-1; b) profile N-2; c) construction of a dismountable parapet made from earth filled bags in a sector of fire ($\sim 60^\circ$) at ground targets; d) plan; e) a sector of fire at ground targets: the parapet in this sector is made dismountable (from earth filled bags, stones and the like); f) radius of turn of the gun barrel; g) recess for ammunition; h) space for blindage; i) water accumulation well; j) recess for ammunition; k) profile N-3.

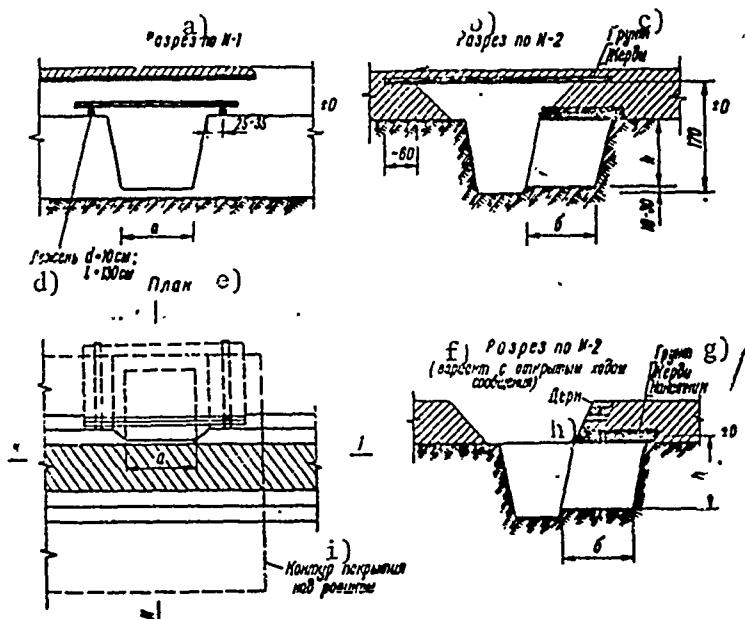


Figure 44

A recess for ammunition.

a) profile N-1; b) profile N-2; c) dirt, poles; d) tie, d = 10 cm, l = 130 cm; e) plan; f) profile N-2 (a variation with an open communication trench); g) dirt, poles, layer; h) sod; i) contour of cover above pit.

The dimensions of a recess depending on the caliber of the ammunition stored in it are given in the data of the following table.

No.	Designation	Dimensions, cm (see Fig. 44)			Wood Products Required m^3	Remark
1	For 82-mm, 120-mm mortars, 82-mm recoilless weapon, 57-mm, 122-mm and 152-mm weapons	110	110	110	0.21	Poles, d = 5-7 cm l = 250 cm
2	For 85-mm, 100-mm cannon	130	110	110	0.22	Poles, d = 5-7 cm l = 270 cm
3	For 107-mm recoilless weapon	140	110	110	0.22	Poles, d = 5-7 cm l = 280 cm

For ground artillery gun aiming stations a trench is constructed for a trailer with the special apparatus and at a distance of up to 50 m a concealed position for a prime mover with a power supply unit is constructed. Next to this a slit trench or a blindage is constructed for the station crew. The trench for the station trailer is excavated with two ramps. The depth of the trench, together with the parapet, should be no greater than the height of the cabin roof of the trailer. For a reconnaissance and target designation station, a trench for the apparatus vehicle, a cover for the power vehicle and a slit trench for blindage for station crew are constructed. The trench for the apparatus vehicle is located 10-20 m from the radio antenna, and the cover for the power vehicle is located no closer than 20-45 m from the apparatus vehicle trench.

The task involved in camouflaging trenches for tanks and artillery is to conceal from the enemy or deceive him in regard to the equipment installed in the trench.

Selection of the place for locating the trench is especially important in camouflaging the equipment.

In populated areas the locations of trenches are selected near terrain features: behind fences, in gardens, in demolished structures and so on. If the fire positions are situated off the roads the approach routes to them should lead to the nearest road or woods. Traces of the way established to the firing position should be carefully camouflaged. Wheel tracks are camouflaged by spreading camouflage material on them (grass, small branches) and by brushing off the ruts and tracks which are formed on a plowed field, on sand or on snow.

Uniformity in camouflaging equipment can attract the attention of the enemy, therefore it is necessary to diversify it.

Trenches in a woods are located under the tops of trees. To create a dense horizontal cover the tops of trees are tied down. The parapets of the trenches are camouflaged with materials at hand and strewn with a vegetating layer of soil, and the bottom of the trenches is covered with branches and so on.

To conceal the trenches and the equipment located in them from ground observation vertical cover placed in front of or to the side of the trench is employed. In populated areas it is most expedient to use fences as vertical cover. Vertical cover is best installed in front of a clump of woods, between shrubbery, between trees and in the intervals between buildings. Vertical covers are most often set up to conceal trenches for anti-tank artillery which are designed for laying direct fire.

As a rule, vertical cover is made from materials at hand, in the form of a wire-pole frame with branches, brushwood and others entwined in it.

Openings are left in the vertical covers for the entire height of the cover to permit the conduct of fire through them. The openings are concealed by means of removable curtains, a portable frame, dropping covers and others. The removable curtains can be made from mesh fiber or from cut vegetation. The barrel of the gun protruding through the curtain (which is fastened by both sides to immovable rings of the vertical cover) contracts or extends its right or left part depending on which way it is turned. In order to compress the curtain or to form a pleat in it, its length is made twice the width of the opening in the vertical cover (Figure 45).

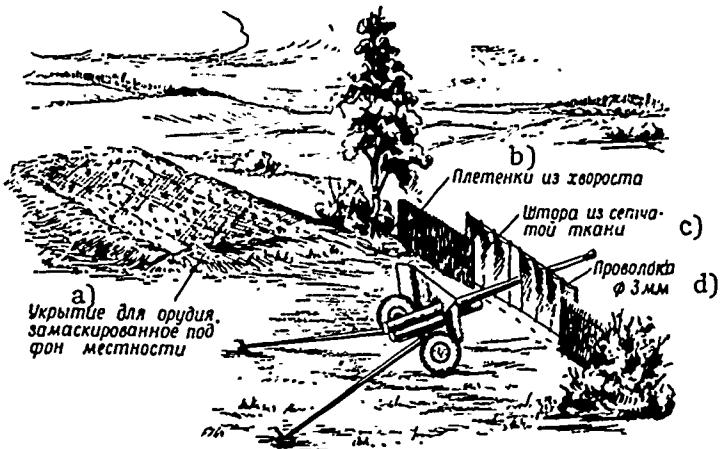


Figure 45
Camouflaging a weapon by means of a vertical cover with a movable curtain.

a) protective cover for the weapon, camouflaged in imitation of the terrain; b) mats made from underbrush; c) curtains made from mesh fabric; d) wire Ø 3 mm.

A movable shield consists of a rigid frame and camouflage material; the shield moves to the right or to the left together with the barrel. The shield is moved on rings along a drawing rod fastened to a frame.

The lowered vertical mat conceals the weapon only before fire is opened.

In open areas of the terrain trenches are camouflaged by vertical covers and by camouflage-overhead covers. The authorized camouflage kits are used to make the camouflage overhead covers. Depending on the location of the equipment in the trench in relation to the ground surface the overhead cover can be flat or raised. Flat overhead covers are installed when the location of the equipment in the trench is below the level of the parapet. Raised overhead covers camouflage the equipment when it is located outside the trench or it is elevated above the parapet.

If there is a large number of zones of bare earth in the area the camouflage-overhead cover should correspond to the color of the thrown

out earth. A thin layer of dirt is sprinkled around the outline of the overhead cover. The removed dirt is scattered so that its border will have a curved outline (Figures 46, 47).

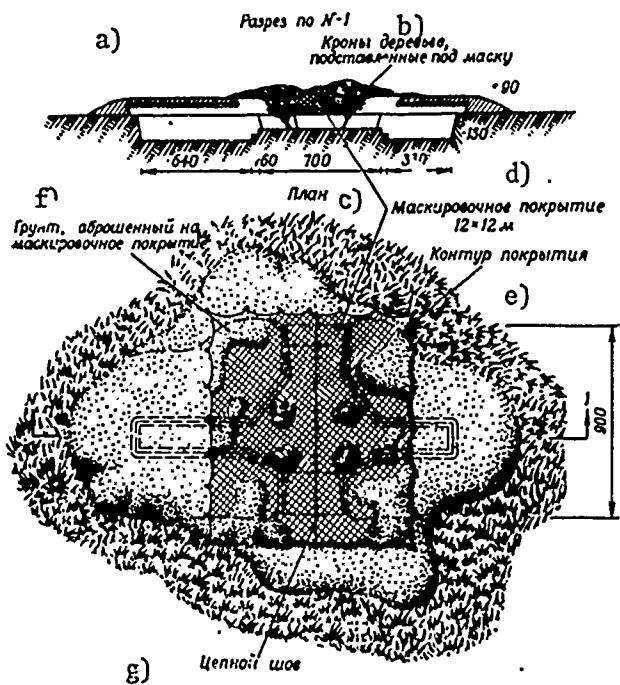


Figure 46
Camouflaging of a trench for an 85-mm gun in imitation of the background of the removed dirt.

- a) profile N-1; b) tops of trees, arranged as camouflage;
- c) plan; d) camouflaged overhead cover, 12 x 12 m; e) contour of overhead cover; f) dirt removed to the camouflage overhead cover; g) chain seam.

When trenches are camouflaged in imitation of the background of the surrounding terrain the parapet is covered with vegetating dirt, on top of which materials at hand are placed (branches, moss, fresh leaves and others). The camouflage-overhead cover is also adjusted to the background of the terrain, and camouflage materials at hand are employed for this (Figure 48). Regardless of the size and outward appearance the overhead cover must permit fire to be conducted from the camouflaged trench.

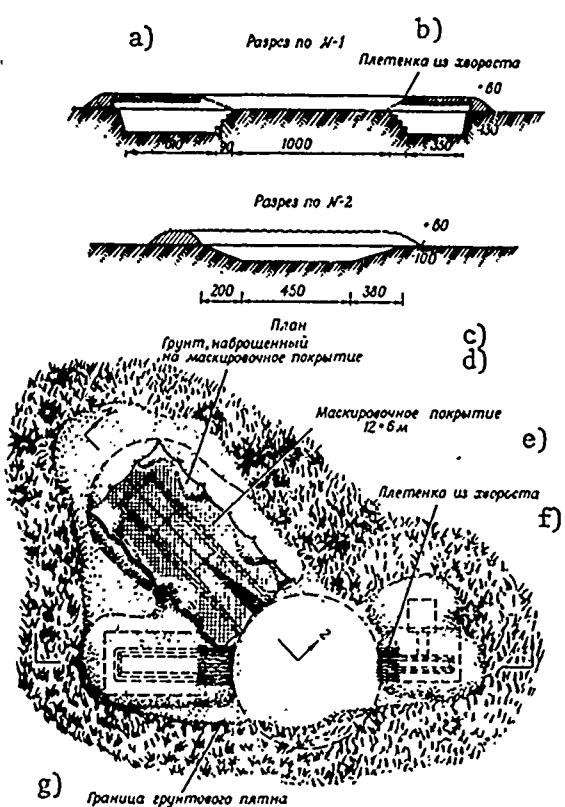


Figure 47
 Camouflage of a trench with a circular field of fire in imitation of the background of removed dirt-
 a) profile N-1; b) mat made from brushwood; c) plan;
 d) dirt removed to the camouflaged overhead cover;
 e) camouflaged overhead cover, 12 x 6 m; f) mat made from brushwood; g) border of earth patch.

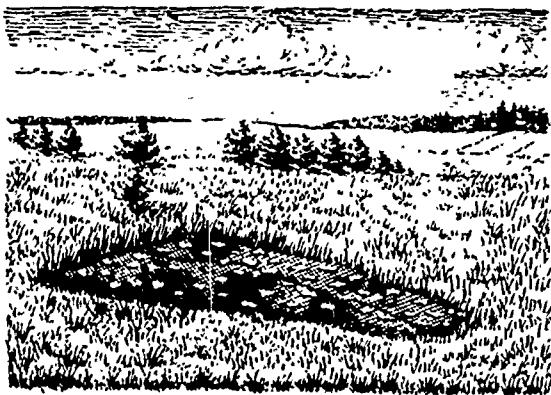


Figure 48
A trench camouflaged in imitation of the terrain background by using a cover made from mesh fabric.

Mortar trenches are concealed by flat camouflage-overhead covers, and in addition a fast opening (chain) seam of the cover is so situated that it is possible to open fire without removing the cover (Figure 49).

When a raised overhead cover is installed frames are placed under it to give the cover an irregular form. The tops of small trees are used as frames. The frames are installed so as to not interfere with the delivery of fire and the work of the crew under the cover. The cover is pulled down and fastened with anchor pins; in addition, the edge of the cover should be tucked under in order to give the camouflage a curved outline in the plan.

The blast areas formed during firing decamouflage the firing position when it is observed and photographed from the air. In summer the blast zones are camouflaged with nets which have camouflage material intertwined in them. The nets are fastened to the parapet by pegs. In winter snow is shoveled off to the blast zone.

It is desirable to select a place for locating tank trenches in terrain sectors which have a broken relief. During the winter the locations for trenches should be selected in areas which have incomplete snow cover.

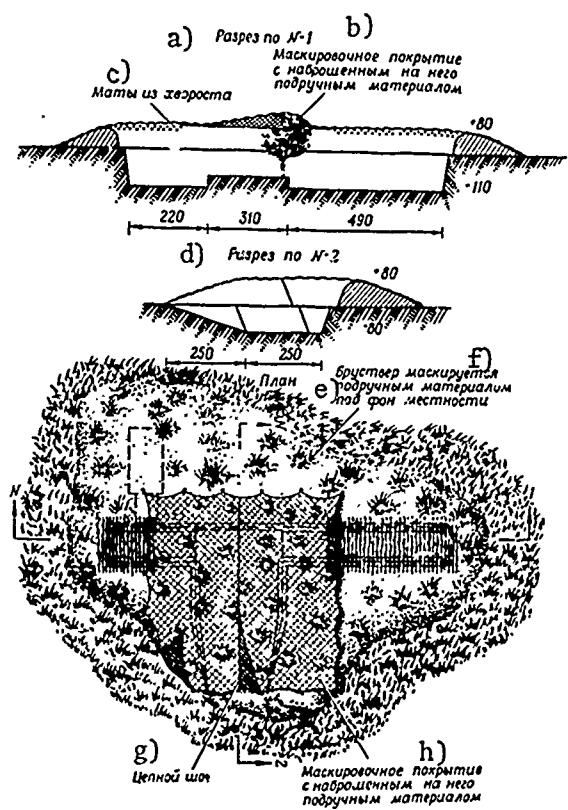
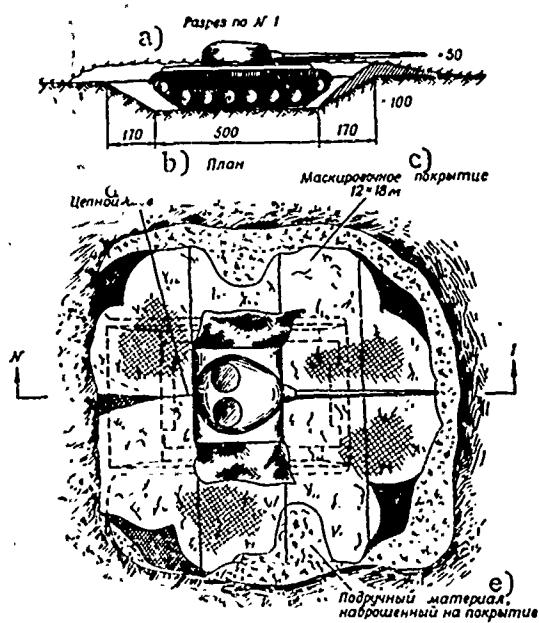


Figure 49
A trench for a 120-mm mortar, camouflaged in imitation of the terrain background.

a) profile N-1; b) camouflaged overhead cover with improvised materials thrown on it; c) mats made from underbrush; d) profile N-2; e) plan; f) the parapet is camouflaged with improvised material in imitation of the terrain background; g) chain seam; h) camouflaged cover with improvised material thrown on it.

The tank installed in the trench is camouflaged with a flat or a raised camouflage-overhead cover, the color and texture of which should correspond to the color and texture of the removed earth or to the terrain background surrounding the trench.

In camouflaging the trench in imitation of the terrain background (after the tank is in the trench) an authorized camouflage cover made from mesh fabric or camouflage nets is spread over the tank. In addition, improvised camouflaging material is entwined in the cover for greater correlation with the terrain background (Figure 50).



a) profile N-1; b) plan; c) chain seam; d) camouflage cover, 12 x 18 m; e) provisional material thrown on the cover.

The part of the cover which camouflages the turret is usually made in the form of an apron which during firing is thrown off. The camouflage cover which is removed is fastened to the ground with pegs. When the trench is camouflaged in imitation of the background of removed dirt a

thin layer of dirt is sprinkled along the outline of the camouflage cover. The angles of the cover are not fastened to the earth, but they are folded under so that there is no rectangle formed in the plan. In order to preserve the cover during firing it is located no closer than 1 m from the muzzle face of the cannon barrel.

If the tank is located outside of a trench or in a shallow trench a convex camouflage-overhead cover is, as a rule, erected over it. In this case it is necessary to see that the sides of the cover surfaces blend in better with the general pattern of the terrain and do not stand out against a given background. To this end, the cover, as pointed out earlier, is propped up from below by the tops of small trees. Sometimes a frame for the camouflage-cover is not constructed and the cover is thrown directly over the camouflaged object (Figure 51). Nets with camouflaged materials intertwined in them are most often used as cover. In winter the camouflage-cover is sprinkled with snow.



Figure 51
A tank located outside the trench and camouflaged by a convex camouflage cover.

Vertical covers are set up to camouflage tanks from ground observation. A vertical cover which is set up on an open terrain is useful when it is a part of a system of covers which are constructed on a large area. The vertical covers are constructed both from authorized materials and from improvised materials. Their construction is the same as that of covers utilized as camouflage for the artillery. It is necessary to cover up the tank tracks leading up to the trenches with materials at hand (underbrush, grass, branches, and so on).

Dummy trenches are constructed to deceive the enemy. The depth of the dummy trenches is 0.3-0.6 m. False trenches which are built in light soils are strewn with peat and slag, and they are covered with spruce branches and other materials which make the bottom dark. Equipment can be simulated in the trenches. A simple frame is set up in the trench and a camouflage cover is thrown over it.

The dummy trenches are camouflaged the same as real trenches are, with this difference only, that the former are more carefully blended in with the background of the surrounding terrain. If the actual trenches are camouflaged in imitation of the background of a patch of bare dirt, the dummy trenches in this case may simulate the creation only of patches which correspond to the patches on which the actual trenches are located.

Figure 52 shows a dummy tank in a trench made from dirt. The mock-up tank and dummy trench are constructed at the same time. The mock-up is made from the untouched dirt left in the dummy trench. The turret and body of the tank are fashioned from turf.

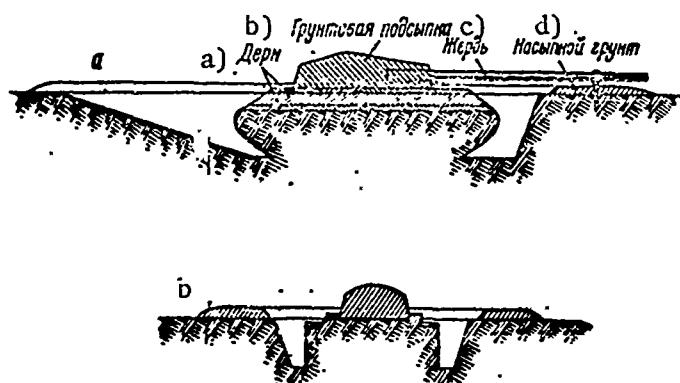


Figure 52
A dummy tank in a trench made from dirt: a - lengthwise profile; b - diagonal profile.
a) sod; b) packed soil; c) pole; d) filled soil.

Such mock-ups are easily made from snow. A box whose outline simulates the object is put together from specially prepared shields and it is filled with snow. The bank obtained is packed down and formed, and then it is covered with dark powders.

Factory prepared mock-ups are used to simulate equipment (portable or towed). Such mock-ups are made from light frames which are covered by thin sails or mesh fabric.

CHAPTER 4

Cover for Combat Material and Transport

Combat materiel and motor transport which is located on open terrain can be destroyed by a shock wave at a rather considerable distance from the epicenter of the atomic explosion.

With the development of methods of effective protection for various combat materiel and motor vehicles against the effect of the harmful factors of an atomic weapon it was found that the utilization of cut-and-cover shelters considerably increased their longevity.

Cut-and-cover shelters are constructed with various dimensions in the plan and at different depths depending on the type of concealed materiel and the terrain on which the cover is situated.

A cut-and-cover shelter includes a trench, one or two ramps for entering and exiting materiel, and a parapet. Depending on the number of ramps there are two types of cover: the dead end, having one ramp (Figure 53), and the pass through cover which has two ramps. The dead end covers which are constructed for the majority of the types of combat materiel and motor transport are the most widespread. The pass through covers, as a rule, are constructed for vehicles with trailers and also for a group of combat vehicles or sedans (Figure 54).

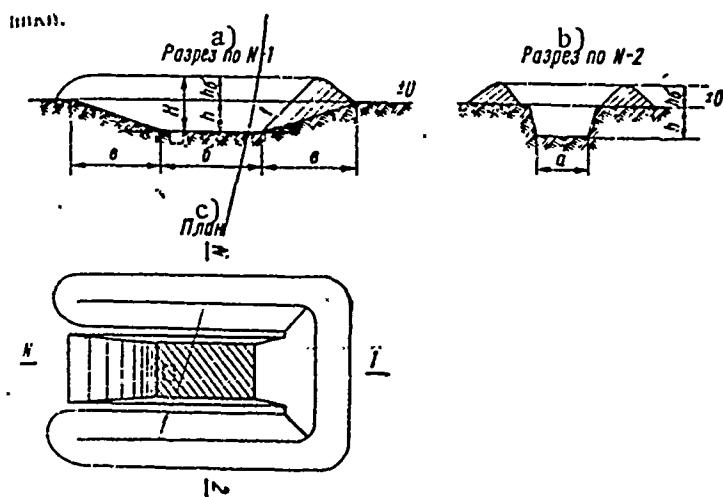


Figure 53
A dead end cover for materiel.
a) profile N-1; b) profile N-2; c) plan.

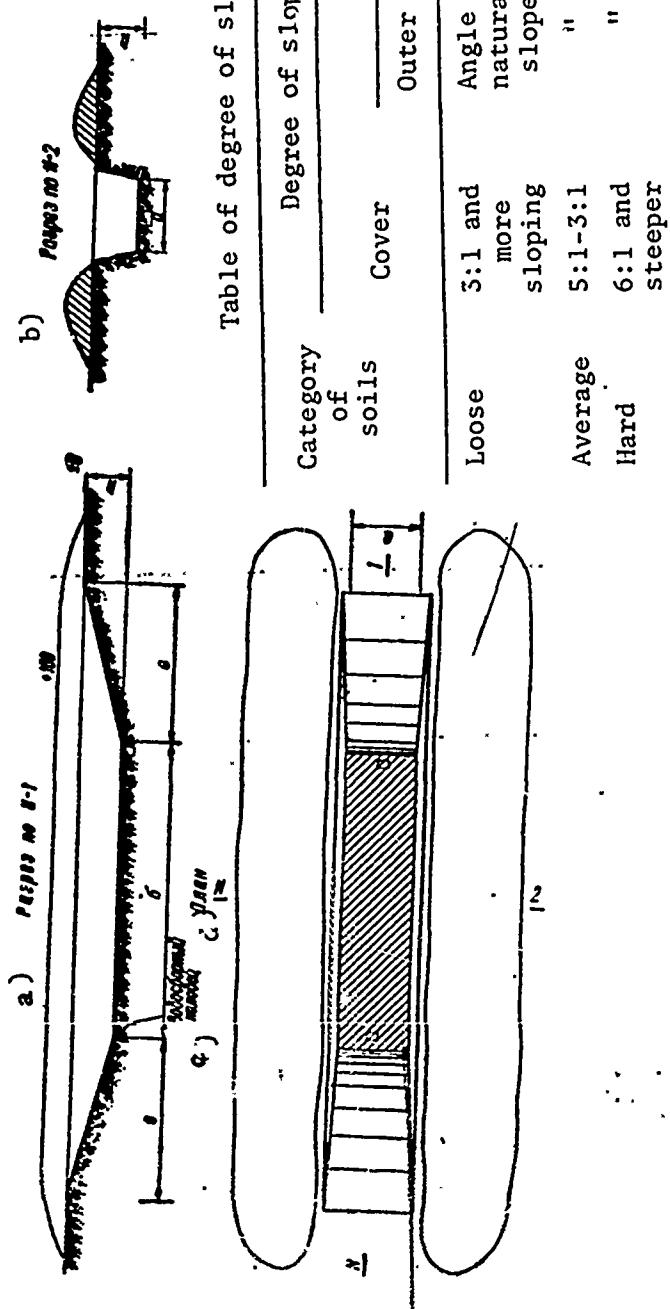


Figure 54
A cover for two vehicles.
a) profile N-1; b) profile N-2; c) water accumulating well; d) plan.

The chief problem in constructing covers is determination of the dimension of the trench along the bottom end of the depth. When the cover is excavated by bulldozers or by tractor mounted bulldozer equipment of artillery prime movers and tanks the minimum width of the covers along the bottom will be determined by the width of the operating organ of these vehicles. However, for some types of materiel such a width is insufficient and requires the construction of a cover, the width of which along the bottom is greater than the width of the operational organ of a bulldozer or of tractor mounted equipment. In this case, as well as when use is made of an excavating machine or when the cover is dug manually, the width along the bottom is determined by the conditions for serving the concealed materiel. For covers up to two meters deep the width along the bottom is assumed to be 60-80 cm greater than the external dimensions of the undercarriage of the materiel.

When setting the length of a cover along the bottom it must be taken into account that part of the body of the combat vehicle or automobile can rest on the ramp. This makes it possible to excavate a cover where the length of the trench along the bottom is somewhat less than the length of the concealed materiel.

For better resistance to collapse the slopes of covers are constructed depending on the quality of the soil and are acceptable up to 3:1 (loose soil), up to 5:1 and 6:1 (average and hard soils).

In the construction of a cover the height of the parapet when possible is determined by the volume of the dirt excavated from the trench and the volume of dirt necessary for the construction of the parapet. The volume of excavated dirt is calculated taking into account the breaking coefficient which for average soils is assumed to be 1.2-1.3. Experience indicates that it is advisable to construct a streamlined parapet with the angle of the external and internal slopes equalling 4:1 or 3:1 (Figure 55). Such a parapet is resistant to the effect of a shock wave, protects men from shrapnel and bullets and requires for its construction less dirt than for a parapet of the same height but with a slanting external slope. Furthermore, to improve the protective qualities of the cover, its parapet is located no farther than 0.5 m from the edge of the trench.

The ramp angle of slope depends on the type of concealed materiel and is adapted so as to insure a rapid exit of the vehicle from the cover. For combat vehicles and tracked prime-movers the ramp angle of slope is 1:2, for wheeled vehicles it is 1:3-1:4. In rainy weather for a rapid exit from a cover constructed in clayey soils a track or solid covering is laid on the ramp and on the bottom of the cover.

The disposition of the concealed covers is of great importance for increasing the ability of combat materiel and vehicle transport to survive. It is well known that when combat materiel and vehicle transport are located on the back slopes of elevations, in ravines and depressions the destructive

action of an atomic explosion is decreased in comparison with materiel which is situated on level or open terrain.

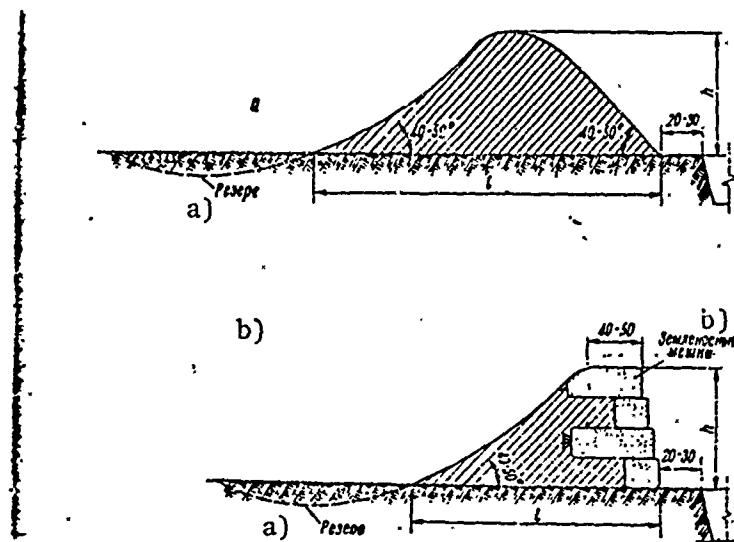


Figure 55

The profile of a raised parapet:

a - without covered slopes; b - with a covered internal slope.
a) reserve; b) dirt-filled bags.

Concealed covers are constructed on back slopes of elevations or in depressions, as illustrated in Figures 56 and 57. To prevent the slopes of such covers from being eroded, mountain ditches are dug 3-5 m above the cover to drain off the surface waters.

The volume of earth moving work is reduced when constructing covers on back slopes and in depressions, and, consequently, the expenditure of energy for building such covers is decreased.

The dimensions of covers for some types of combat materiel, prime movers and motor vehicles are cited below in the table.

The dimensions of covers for some types of materiel where two vehicles are located in each cover are cited in the second table below.

To camouflage the covers and the materiel placed in them the camouflage materials of the terrain are first of all utilized. It is most advisable to place covers in hilly terrain, by precipices, in woods and ravines.

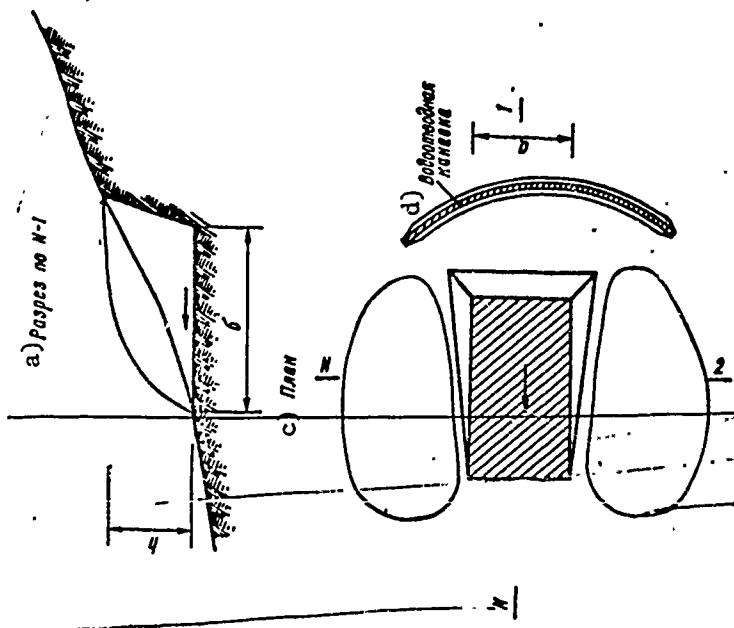


Table of dimensions and volumes of parapets

Parapet profile (see Fig. 55)	h	1	Volume of dirt filled for 1 linear m of parapet, m^3	Parapet for 1 profile	h	1	Volume of dirt filled for 1 linear m of parapet, m^3	Dirt filled bags for 1 linear m of parapet, m^3
20	60	0.05	-	-	60	140	0.35	7
30	30	0.15	-	-	70	155	0.50	7
40	120	0.25	-	-	80	170	0.65	11
50	150	0.35	-	-	90	185	0.80	11
With un-covered slopes	60	180	0.50	With covered	100	200	1.00	13
70	210	0.70	-	covered	110	215	1.25	13
80	240	0.90	-	internal	120	230	1.50	17
90	270	1.10	-	slopes	130	250	1.80	17
100	300	1.40	-					
110	330	1.70	-					
120	360	2.10	-					
130	390	2.50	-					

-61-

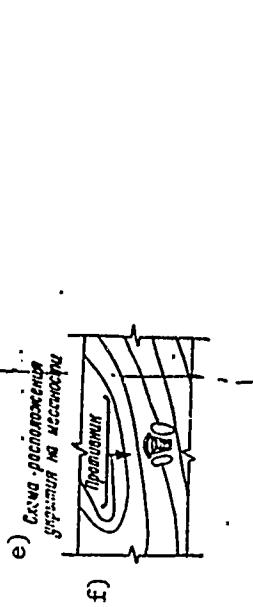


Figure 56

A concealed cover, located on a back slope.
 a) profile N-1; b) profile N-2; c) plan; d) water accumulation ditch; e) diagram of disposition of cover on terrain; f) enemy

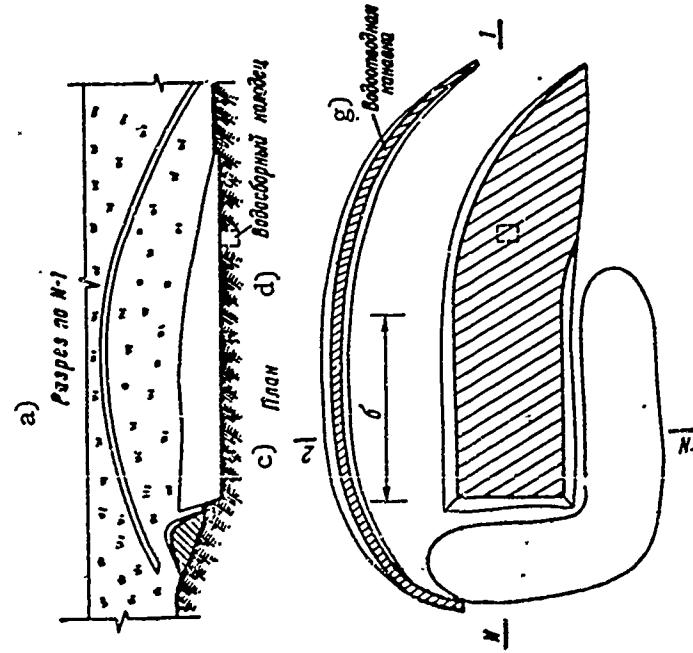


Table of steepness of slopes

Type of soils	Cover	Steepness of slopes	
		Internal slope	External slope
Loose	3:1 and more sloping	Angle of natural slope	1:1.5-1:2
Average	5:1-3:1	"	1:1.5-1:2
Hard	6:1 and steeper	"	1:1.5-1:2

Figure 57

A concealed cover located in a depression
 a) profile N-1; b) profile N-2; c) plan; d) water accumulation well; e) diagram showing location of cover on the terrain; f) enemy; g) drainage ditch.

Nomenclature and make of vehicle	Dimensions of cover, m (see Figs. 53, 56, 57)					
	a	b	c	h	hb	H
Automobile GAZ-69	2.3	3.0	2.5	0.9	1.0	1.9
Automobile GAZ-63	3.0	4.3	3.6	1.2	1.0	2.2
Automobile GAZ-62	2.5	4.5	3.6	1.2	1.0	2.2
Automobile ZIL-150	3.0	5.0	3.6	1.2	1.0	2.2
Automobile ZIL-151	3.0	5.8	5.5	2.0	1.0	3.0
Automobile ZIL-157	2.5	3.5	5.5	2.0	1.0	3.0
Automobile MAZ-200	3.3	7.0	7.0	1.5	1.0	2.5
Automobile YaAZ-210	3.5	8.5	8.0	1.6	1.0	2.6
Light prime mover AT-L	3.0	5.0	3.6	1.2	1.0	2.2
Medium prime mover AT-S	3.4	5.4	3.0	1.5	1.1	2.6
Heavy prime mover AT-T	3.6-4.0	6.5	3.3	1.8	1.1	2.9
Prime mover AT-P	3.0	4.5	2.5	0.9	1.0	1.9
Armored transport BTR-40	2.4	4.0	2.8	1.0	1.0	2.0
Armored transport BTR-152	2.8	5.5	5.0	1.8	1.0	2.8
Automobile 485 (BAV)	3.0	7.0	3.6	1.3	1.0	2.3
Automobile GAZ-46 (MAV)	2.2	4.5	2.0	0.7	1.0	1.7
Tractor C-80	3.0	3.8	3.2	1.8	1.0	2.8
Bulldozer D-271	3.0	5.0	5.0	1.8	1.0	2.8
Grader D-144	4.0	7.5	5.0	1.8	1.0	2.8
Automobile with a pontoon unit	3.0	6.0	5.5	2.0	1.0	3.0
Excavator E-302	3.5	4.0	15.0	2.0	1.5	3.5
Excavator ETR-152	3.0	5.5	15.0	2.0	1.5	3.5

Nomenclature and make of vehicle	Dimensions of cover, m (See Fig.54)			
	a	b	c	h
Automobile GAZ-69 and prime mover AT-P	3.0	6.5	2.5	0.9
Automobile GAZ-63; GAZ-62; ZIL-150 and light prime mover AT-L	3.0	10.5	3.6	1.3
Automobile ZIL-151; ZIL-157 and automobile with pontoon unit	3.0	13.0	5.5	2.0
Tractor C-80	3.0	7.8	3.2	1.8
Heavy prime mover AT-T	3.6-4.0	12.5	3.3	1.9
Automobile 485 (BAV)	3.0	14.6	3.6	1.3
Automobile GAZ-46 (MAV)	3.0	8.5	1.9	0.7
Armored transport BTR-40	3.0	9.0	2.8	1.0
Grade D-144	3.6-4.0	16.0	5.0	1.8
Medium prime mover AT-C	3.5	12.5	3.0	1.6
Armored transport BTR-152 and bulldozer D-271	3.0	11.5	5.0	1.8
Excavator E-302 and ETR-152	3.2	11.5	14.5	2.7

When the ditches for the covers are mechanically excavated the area of damaged vegetable cover is considerably increased. In connection with this it is practically impossible to resod all the parts having damaged cover. Therefore for camouflaging the protective covers it is advisable to utilize camouflage cover in imitation of the sections having damaged vegetable cover. To do this a flat camouflage-overhead cover is placed over the protective cover and it is situated, as a rule, on the same level as the earth's surface. A tent canvas or the authorized camouflage kit, which is stretched directly over the ditch or mounted on a frame, is utilized as the camouflage cover.

If a cover of the authorized camouflage kit is utilized for the camouflage-overhead cover in imitation of a section of damaged vegetation, it should be made from mesh fabric of a desert background. The edges of the cover are sprinkled with dirt, and in order that the cover does not sag cut branches and the tops of small trees are placed under it. A good camouflage effect is achieved if the authorized canvases are utilized in combination with the camouflage kits to conceal materiel in covers.

When there is manpower, facilities and time available to camouflage the materiel it is advisable to employ a rigid camouflage-overhead cover consisting of a pole or board frame covered with a thin layer of dirt. Furthermore, rigid camouflage-overhead covers give protection from bad weather and luminous radiation (Figure 58).

If it is necessary to camouflage a cover which is located on a background of a meadow or bushes it is advisable to employ (Figure 59) camouflage-overhead covers which simulate the background of the terrain surrounding the cover. Provisional camouflage material is usually employed to imitate such a background: cut branches or mown grass. However, they must be carefully employed since the texture of branches differs from the texture of grass cover and, consequently, the protective cover which is camouflaged by branches on a grass background will stand out sharply. Furthermore, the cut branches will quickly change their color which considerably reduces the camouflage effect.

A good result is achieved when covers made from camouflage nets interlaced with strips made from fabric, paper or vinyl chloride film of a corresponding color are employed.

A good effect is also obtained with the employment of mesh fabric having large patches of paint. When a rigid camouflage-overhead cover is constructed above sod is laid on it. The parapet can be sodded or strewn with grass, branches, underbrush, moss, leaves and so on.

The entrance to the concealed cover is camouflaged with a covering which is put to one side when it is necessary to occupy the concealed cover (Figures 60,61). A good camouflage effect is achieved by camouflaging the entrance ramps with shell holes.

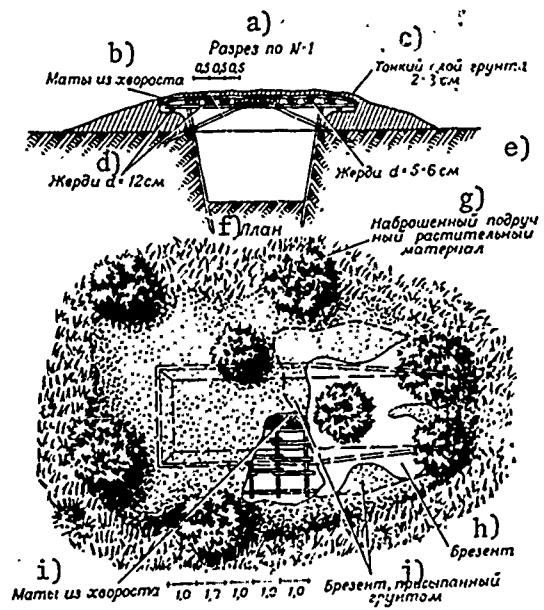


Figure 58

A cover camouflaged under a dirt patch with a rigid camouflage-overhead cover.

Remark. The underbrush or straw mats are prepared beforehand. Before the materiel is placed in the cover the ramp is covered with improvised material (tops of trees, branches).

a) profile N-1; b) mats made from underbrush; c) a thin layer of dirt 2-3 cm; d) poles $d = 12$ cm; e) poles $d = 5-6$ cm; f) plan; g) strewn provisional green material; h) canvas; i) canvas sprinkled with dirt; j) mats made from the underbrush.

To do this the dirt excavated from the ditch is scattered on all sides and above the parapet a concave camouflage-overhead cover made from mesh fiber is built.

In a number of cases the cover can be camouflaged so as to appear to be unoccupied by materiel. Such a method of camouflage is accomplished with the use of flat camouflage-overhead covers made from authorized or provisional camouflage materials. A camouflage-overhead cover simulating excavated dirt is put up directly over the materiel only. The remaining part of the cover and ramp where a small volume has been excavated is simulated in imitation of an unoccupied cover. It is not necessary to camouflage the parapet, ramp, wheel and tank tracks when such a method is employed (Figure 62).

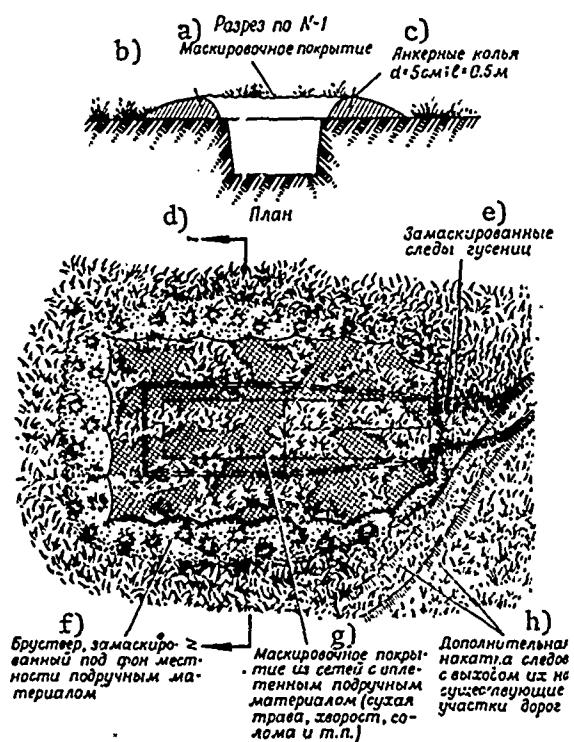


Figure 59

A concealed cover camouflaged in imitation of the terrain background.
 a) profile N-1; b) camouflage cover; c) anchor pegs $d = 5$ cm; $l = 0.5$ m;
 d) plan; e) camouflaged tracks; f) parapet camouflaged in imitation of
 the terrain background using provisional material; g) a camouflage cover
 made from nets interlaced with provisional materials (dry grass, under-
 brush, straw and so on); h) an additional running out of the tracks with
 their exit to the existing sections of roads.

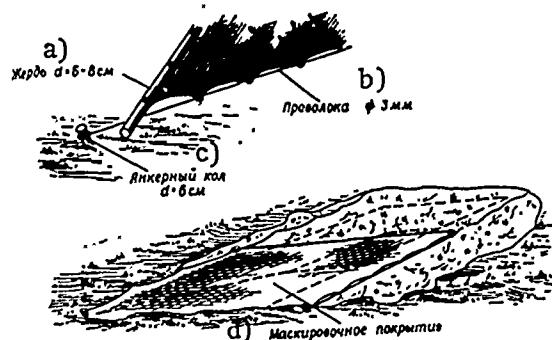


Figure 60
Camouflaging the entrance ramp with a removable blind.
a) pole $d = 6-8 \text{ cm}$; b) wire $\phi 3 \text{ mm}$; c) anchor peg $d = 6 \text{ cm}$;
d) camouflage cover.

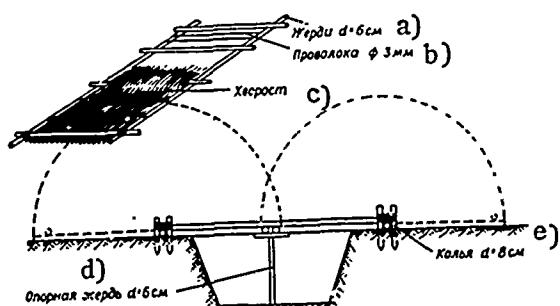


Figure 61
Camouflaging the entrance ramp with foldaway shields.
a) poles $d = 6 \text{ cm}$; b) wire $\phi 3 \text{ mm}$; c) underbrush; d)
support pole $d = 6 \text{ cm}$; e) pegs $d = 8 \text{ cm}$.

On a background of bushes, if there are no authorized materials, protective covers for materiel can be camouflaged in imitation of destroyed covers and covers overgrown with underbrush. For this a wire frame is constructed above the ditch and cut bushes and tops of trees are placed on it (Figure 63). The parapet is also covered with cut vegetation.

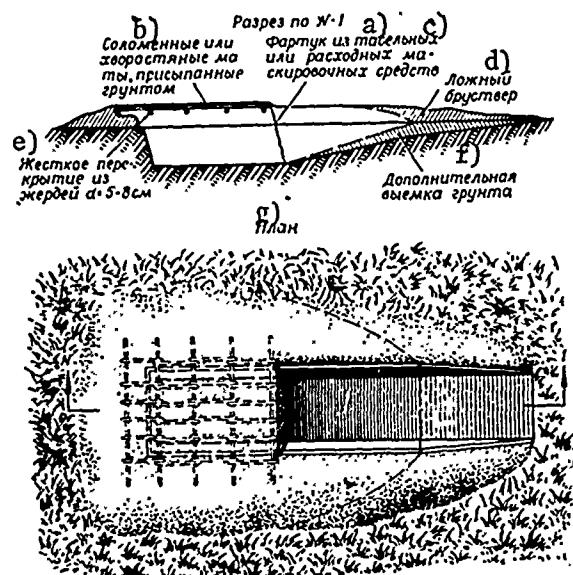


Figure 62

A cover camouflaged as an unoccupied cover.

Note. The additional removal of dirt and banking up of a false parapet is performed manually.

a) profile N-1; b) straw or underbrush mats strewn with dirt; c) apron made from authorized or expendable camouflage materials; d) dummy parapet; e) rigid overhead cover made from poles $d = 5-8$ cm; f) additional removal of dirt; g) plan.

To deceive the enemy dummy covers are constructed alongside of real covers.

Authorized camouflaging kits are utilized to camouflage vehicle transport in protective covers.

Special attention should be given the camouflaging of wheel and caterpiller tracks when camouflaging protective covers. Tracks leading up to the covers are camouflaged by throwing cut vegetation on them. In winter the tracks are camouflaged with snow. One of the most effective methods of camouflaging tracks is spreading a patch of excavated dirt under which the cover is camouflaged, and including all of the tracks at the entrance in this patch. The tracks leading to the concealed cover should be continued until they connect with an existing road.

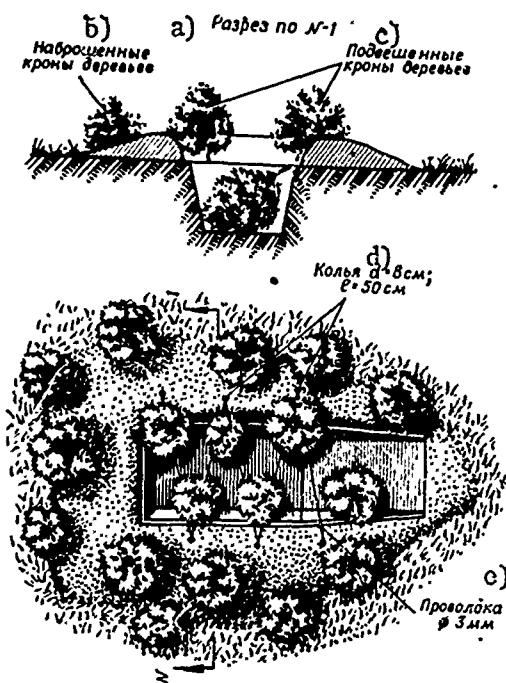


Figure 63
The camouflage of a cover in imitation of a ruined and overgrown cover.

Note. When the cover is occupied the tops of the trees are removed and thrown on top of the camouflaged materiel.

a) profile N-1; b) tops of trees which have been thrown on; c) hanging tops of trees; d) pegs $d = 8$ cm; $l = 50$ cm; e) wire F 3 mm.

When materiel is positioned in natural protective cover (by cliffs, and ravines) it is camouflaged by means of authorized materials or camouflage materials at hand. When materiel is placed in narrow ravines it is covered by flat camouflage-overhead covers (Figure 64).

When materiel is placed by steep inclines it is camouflaged with overhead covers bordering on the inclines. The frame of the overhead

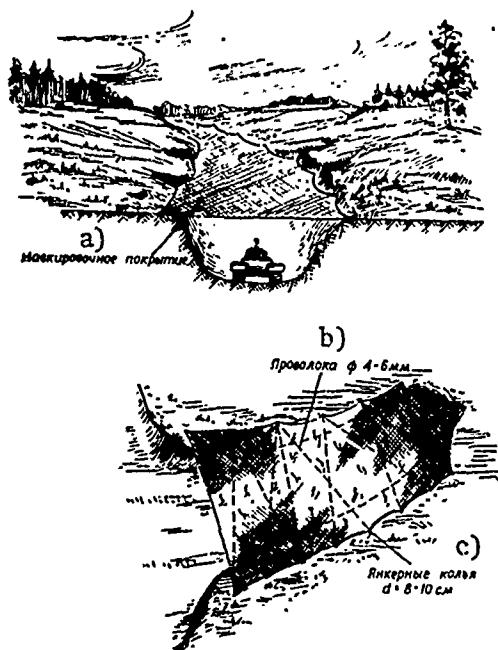


Figure 64
 Camouflaging materiel in a ravine.
 a) camouflage cover; b) wire F 4-6 mm; c) anchor pegs,
 $d = 8-10$ cm.

cover is constructed from poles. One of the variations of such a frame is shown in Figure 65.

Each support of the frame consists of three poles 6-8 cm in diameter tied together below with 3-4mm wire. Horizontal cantilevers, which are also tied together, are fastened to the top ends of the pole supports. To blend the overhead cover into the terrain relief the frame supports are made different heights. A camouflage net interlaced with camouflage materials at hand corresponding to the terrain background is thrown onto the frame.

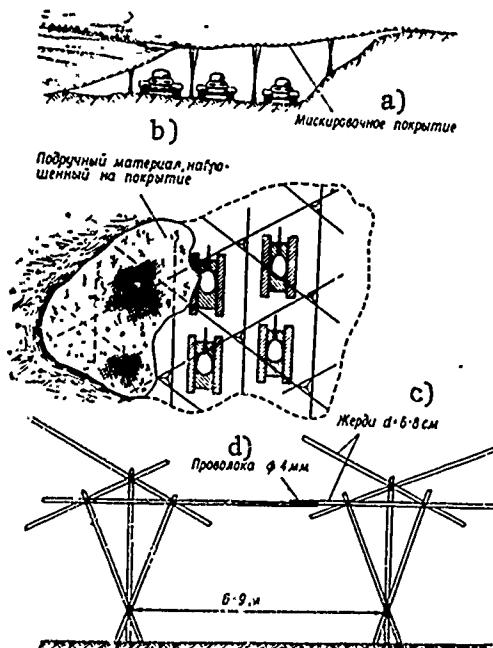


Figure 65
 Camouflaging material with a raised camouflage-overhead cover.
 a) camouflage cover; b) materials at hand thrown on the cover;
 c) poles $d = 5-8$ cm; d) wire $\varnothing 4$ mm.

So called camouflage hangers are constructed to camouflage materiel located alongside cliffs (Figure 66). To accommodate their use, and also to better camouflage vehicle tracks, the hangers should be built near roads. Authorized and expendable camouflage covers made from mesh fiber are employed most often to built the hangers.

The width of a camouflage hanger usually equals 3-3.5 m; its length should provide room for 3-4 vehicles. The camouflage hangers are constructed, as a rule, on approaches to river crossings and in defile, that is, where congestions and a concentration of materiel are possible.

To camouflage materiel situated outside of protective covers and trenches raised camouflage-overhead covers, horizontal screens, vertical

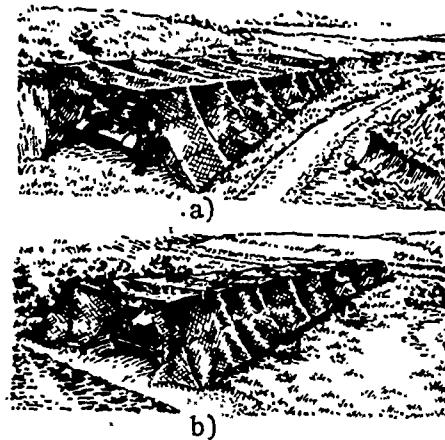


Figure 66
 The construction of camouflage hangers:
 a - for concealing equipment by a cliff; b - used in a camouflage capacity on a road (the camouflage imitates the road).

and inclined screens, and also decoys are assembled from authorized camouflage kits. To conceal materiel using a raised camouflage-overhead cover the cover is thrown onto the camouflaged object (Figure 67) and props of various heights are placed under the camouflage cover making it possible to disguise the shape of the camouflaged object.

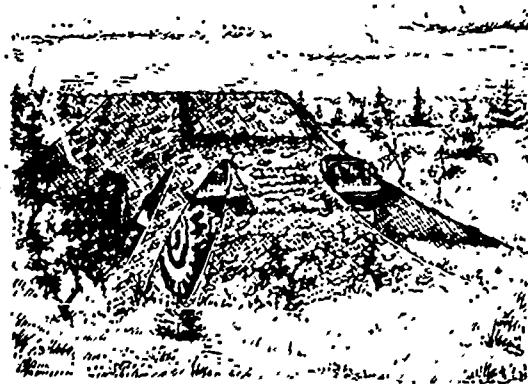


Figure 67
 Camouflaging an automobile with a raised camouflage-overhead cover made from netting.

It is recommended that a camouflage decoy be constructed to camouflage materiel situated in populated areas. The simplest camouflage decoys can be produced in the form of domestic structures.

To camouflage vehicles situated on terrain which is not visible from enemy ground observation points horizontal covers are constructed. Camouflage nets interlaced with strips made from paper SMB are utilized as cover for these.

To distort the outward appearance of materiel when in motion and when parked individual deforming camouflage is being more and more often employed. These camouflage covers usually consist of separate, equipped covers of frames fastened to the sides of the vehicles' surfaces.

The frames of the covers are made in the form of opening fans, rosettes or collapsible planes. Poncho or mesh fiber colored to blend in with the terrain background is attached to the frames. The best effect is achieved when the materiel has been decorated with the deforming camouflage covers and is located in shrubbery or in a clump of trees.

When there are no authorized camouflage facilities maximum use is made of the camouflaging means of the terrain (Figure 68). Thus, when the vehicle is located in a woods it can be concealed under the dense tops of trees which have been tied together, or small trees and bushes can be cut and then thrown or mounted by the vehicle. When the tops of trees are tied together to camouflage vehicles the trees should be 1.5-2 times greater than the height of the vehicle. When small groups of trees or a sparse woods is used as camouflage cut tree tops are strung on wires between the trees.

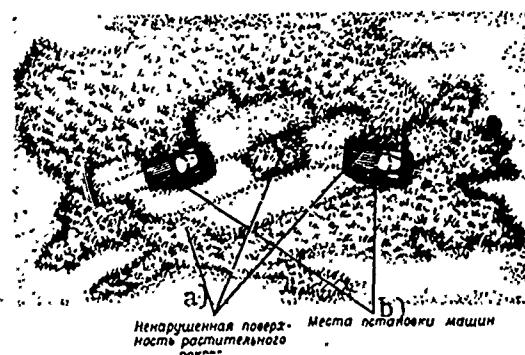


Figure 68
The disposition of materiel in artificially created earth patches.
a) undisturbed surface of foliage cover; b) parking places for vehicles.

Protective canvases in combination with camouflage materials at hand are utilized on more open terrain.

In populated centers which in respect to camouflage are more favorable for the concealed disposition of vehicles, it is necessary to utilize existing sheds, barns and so on.

In all cases the shady side of structures must be utilized. In damaged population centers the materiel is camouflaged best of all in ruins.

CHAPTER 5

Structures for Observation

The conduct of modern combat is impossible without well organized observation. One of the elements insuring organized observation is structures for observation.

These structures should provide the observation posts for the commander of the podrazdelenie the possibility of observing the terrain surrounding him and the actions of forces.

The structures for observation are situated on terrain in a manner which allows them to utilize its protective and camouflage properties.

Structures for observation are usually located on the slopes of elevations.

The observation point of a company commander consists of several positions for observers which are interconnected by communication trenches, and concealed covers of the open or covered type in which the commander of the podrazdelenie, observers, communications men and messengers are located.

Structures for observation are constructed both in a trench and outside. To observe from a trench any rifleman position is utilized which is situated near a concealed cover (blindage or shelter) which can be quickly occupied in case of necessity.

If there is no blindage or shelter near the position a two-man recess is constructed for the observers.

The observation point of a company commander can be constructed with an open structure for observation and a concealed cover of the open type with an earth seat (Figure 69). An open structure for observation is made 1.4 m deep so that it is possible to observe the field of combat standing on the bottom of the pit. One or two observation slits are dug in this structure. The dimensions of the slits depend on the size of the sector of observation.

Observation slits are covered overhead with materials at hand; this increases the protection of the observers against small arms fire and improves the camouflage of the structure (Figure 70). The cover above observation slits is constructed, as a rule, at the same time that the structure is excavated.

It is advisable to equip a structure for observation with a light overhead trench cover which protects the observer from bullets and fragments, luminous radiation, poisonous and incendiary substances.

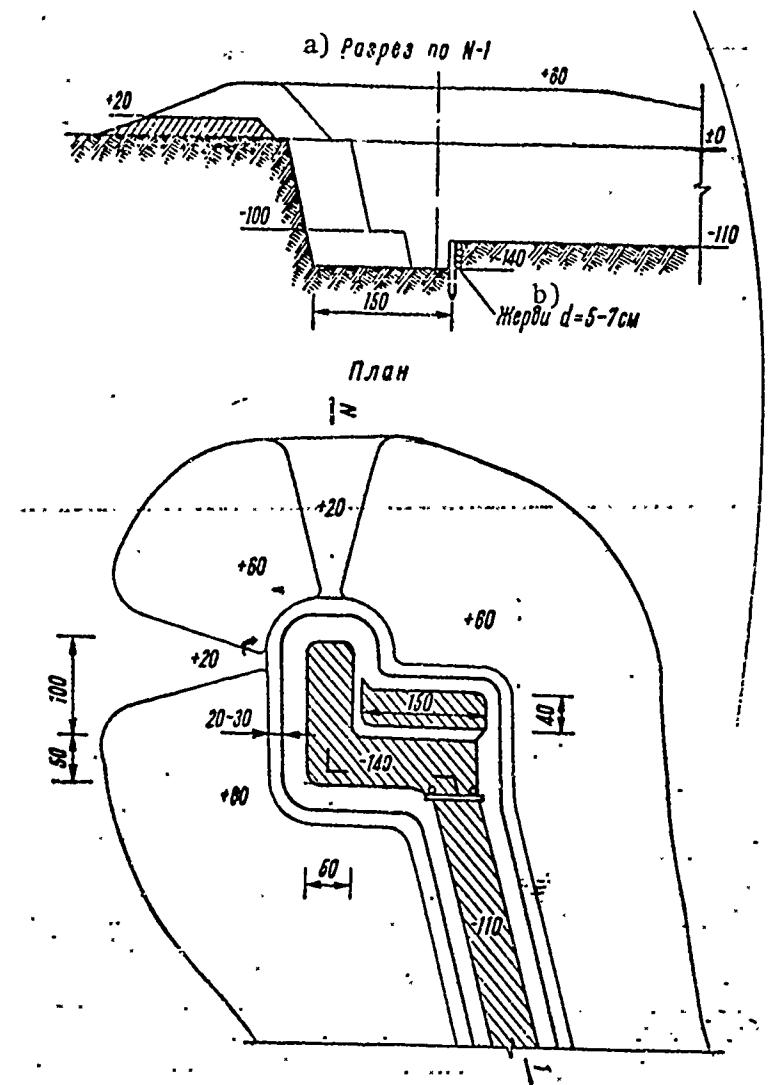


Figure 69

An open structure for observation of a company commander (platoon).

The volume of dirt excavated is 5.0 m^3 . 7.0 manhours are required for construction.

a) profile N-1; b) poles $d = 5-7 \text{ cm}$.

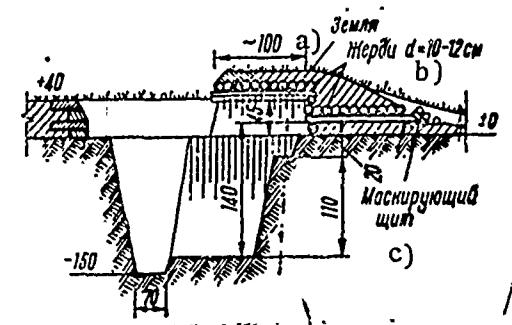


Figure 70
 Profile of an observation slit in a structure for observation of
 a platoon commander (company).
 15 manhours are required for constructing the slit. a) dirt;
 b) poles $d = 10-12$ cm; c) camouflage screen.

Open type artillery observation points are built for observing ground and air targets, and also for observing the results of fire and the actions of supported podrazdelenie. The places for positioning observation points are selected so as to insure the accomplishment of the assigned mission, good visibility, concealed disposition and camouflage. The forward artillery observation points are usually located in a system of trenches which provides the best communication with the supported podrazdelenie.

A battery commander's observation point (Figure 71) usually consists of six positions: for the battery commander, reconnaissance scout, computer, telephone operator, radio telephone operator and a reserve means of communication. Dirt benches are built for location and work in the positions. When there is not enough time the positions for the telephone operator and computer are not constructed. In this case the telephone operators and computers are placed in the battery commander's position. The position for locating the reserve means of communication is cut into the slope of the communication trench which connects the observation point with a concealed shelter (blindage or shelter of the light type).

When there is time and materials a cover is constructed above the positions. Holes or flooring are built directly on beams. Such a location of the flooring increases its work under the effect of the dynamic loads of an atomic explosion. On top of the flooring sod with the grass down is laid so that the dirt placed on the cover will not seep into the position. If rolled water proofing material is available it is advisable to place it on the cover for protection against the penetration of surface waters.

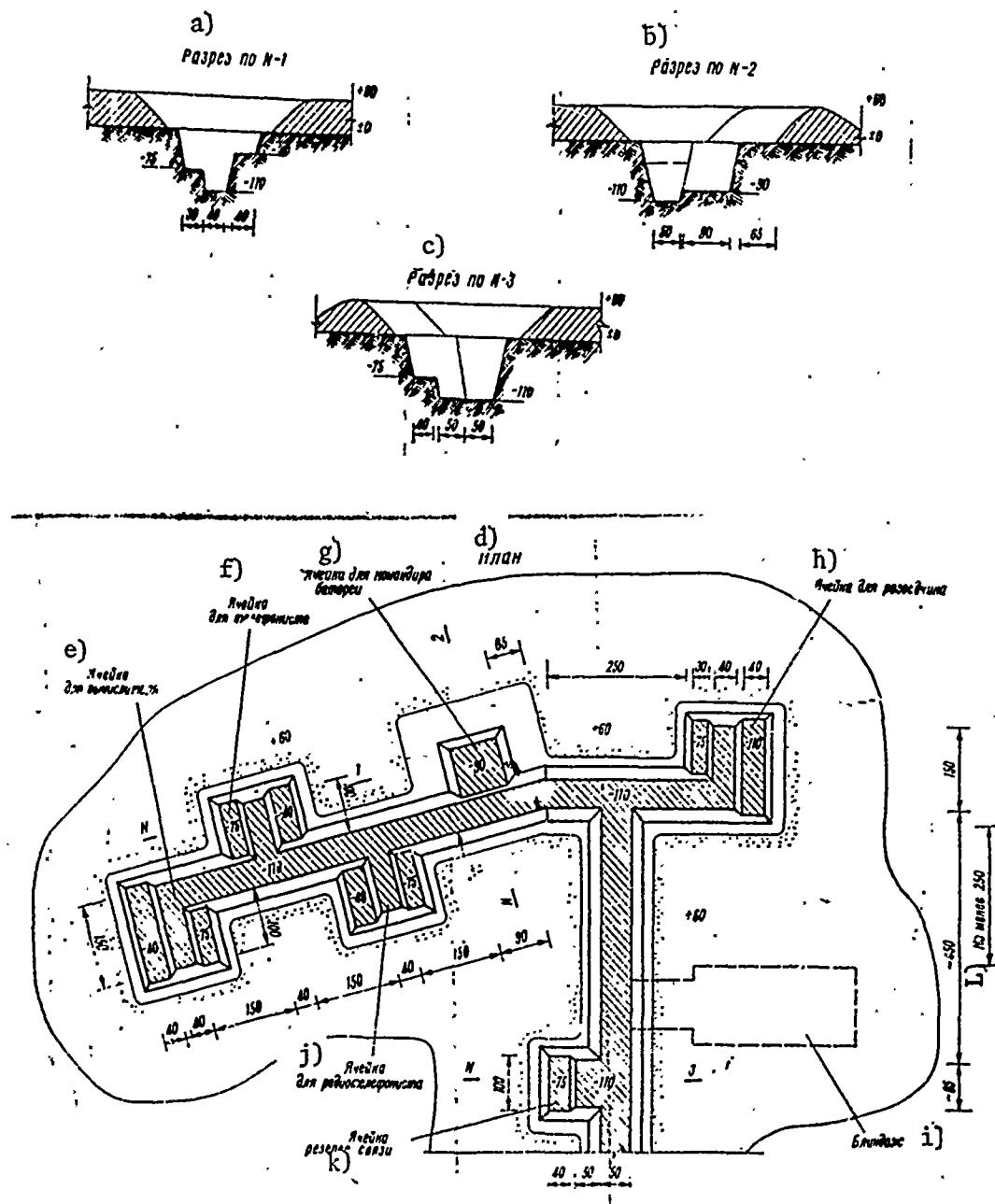


Figure 71

A structure for observation on a battery commander's observation point. The volume of dirt excavated is 25.0 m^3 . 35.0 manhours are required for construction.

a) profile N-1; b) profile N-2; c) profile N-3; d) plan; e) position for computer; f) position for telephone operator; g) position for battery commander; h) position for reconnaissance scout; i) blindage; j) position for radio-telephone operator; k) position for reserve communications; 1) no less than 250.

An open type structure for the senior officer of a battery (Figure 72) consists of three positions (for the senior officer of the battery, for the radio operator and for the telephone operator) which are connected by a communication trench 1.1 m deep. To diminish the volume of work in excavating the communication trench and to create the necessary height of concealment (1.7-1.8 m) a parapet 0.6 m high is constructed. The structure is equipped with steps at the exit and a water accumulation well and with time and materials permitting, a cover made from a flooring and dirt 30-40 cm deep is constructed.

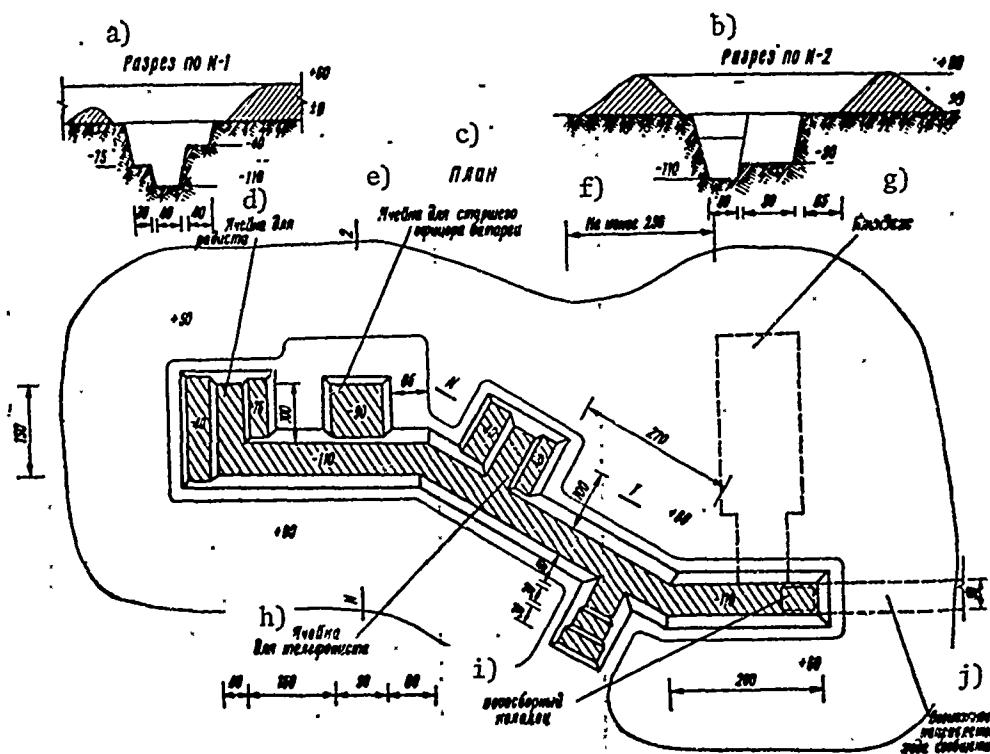


Figure 72
Structure for the senior officer of a battery.
The volume of excavated dirt is 13.0 m³. 25.0 manhours are required for construction.

- a) profile N-1; b) profile N-2; c) plan; d) position for radio operator; e) position for the senior officer of the battery; f) no less than 250; g) blindage; h) position for telephone operator; i) water accumulation well; j) possible direction for communication trench.

For a battery commander of anti-aircraft artillery an open type structure for observation (Figure 73) consisting of five positions (for radio operators, reconnaissance scouts and the anti-aircraft battery commander's observation instrument) and platforms on which the battery commander, telephone operators, instrument men and lines of synchronized transmission are located.

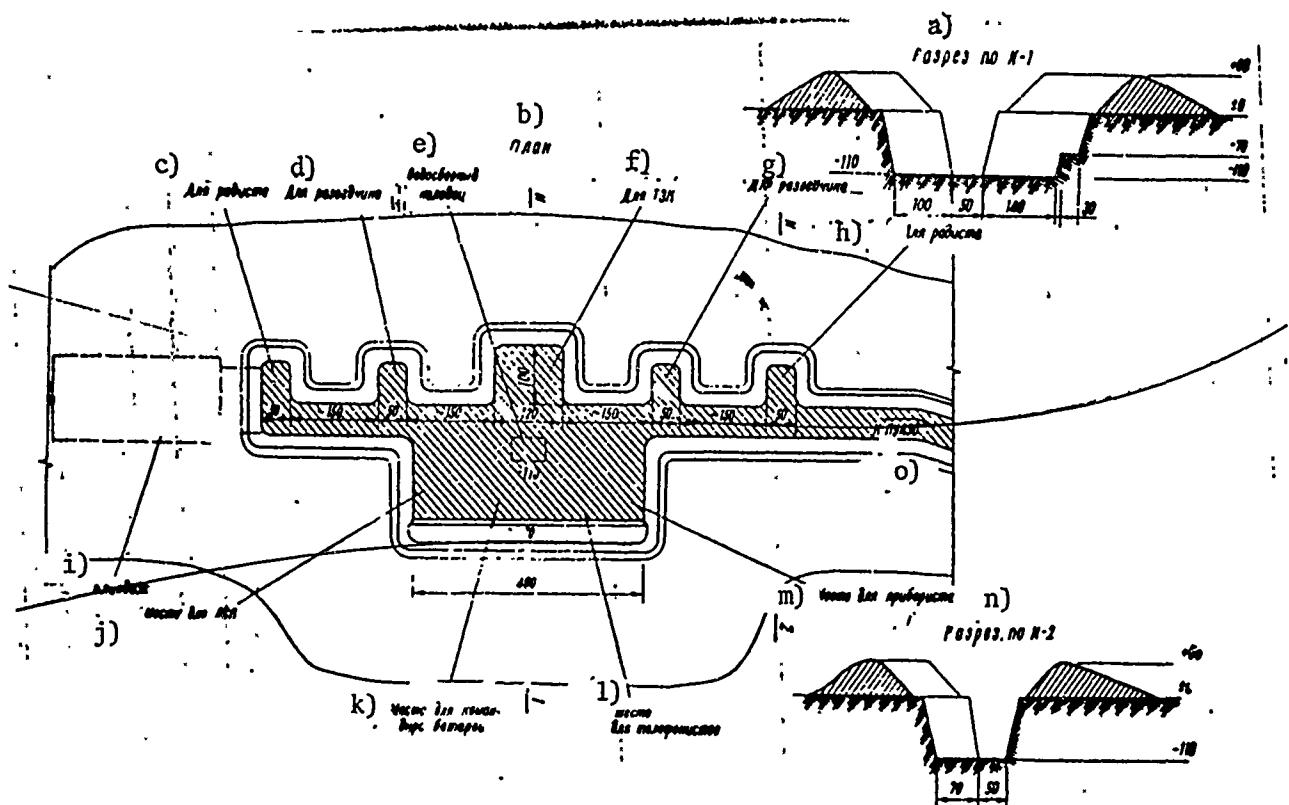


Figure 73
An open observation point of an anti-aircraft artillery battery commander.

The volume of dirt excavated is 18.0 m³. 34.0 manhours are required for construction. a) profile N-1; b) plan; c) for radio operator; d) for reconnaissance scout; e) water accumulation well; f) for anti-aircraft battery commander's observation instrument; g) for reconnaissance scout; h) for radioman; i) blindage; j) place for panel station; k) place for battery commander; l) place for telephone operator; m) place for instrument man; n) profile N-2; o) to anti-aircraft director.

A position and a concealed cover are constructed for a platoon commander of an anti-craft battery control (Figure 74).

An engineering observation post is equipped with one or two positions for observation (Figure 75). The forward part of the berm of the position is made wider for work with optical instruments. A plotting-board and a journal for recording the observation data are placed on it. A recess is built in the front slope of the position to protect the observation instruments. The positions for the observers of the engineer observation post are usually situated in the forward slope of the trench. Open type concealed covers with dirt benches where the observation shifts can rest are constructed between the positions.

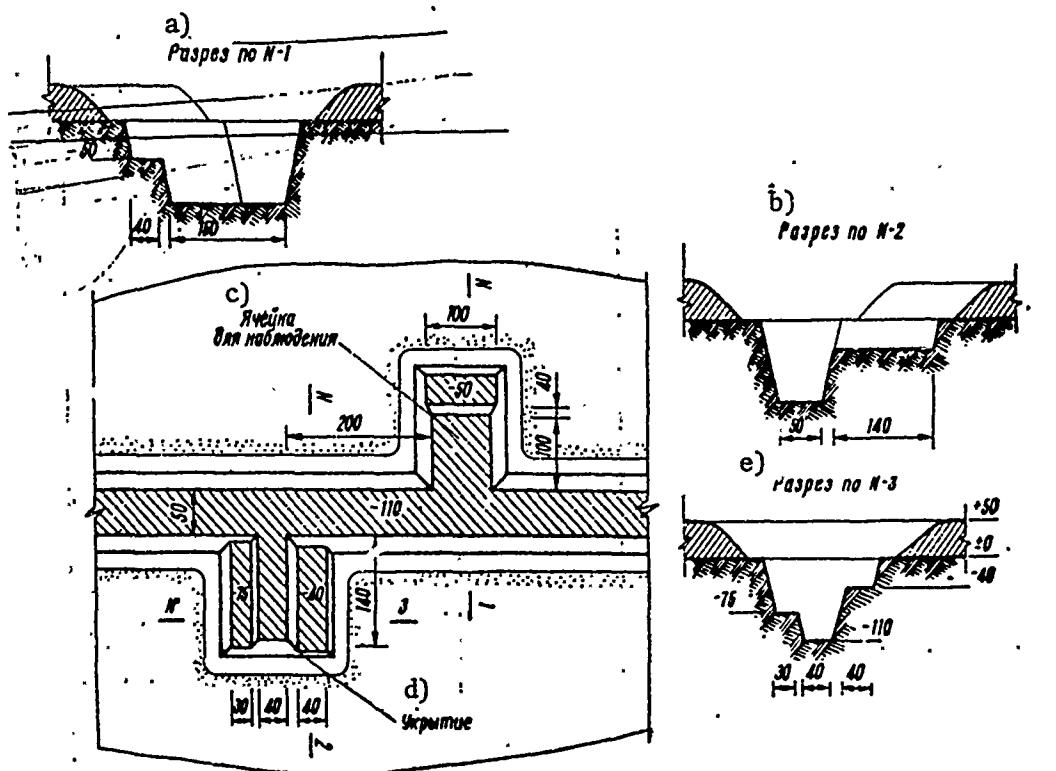


Figure 74
A structure for a platoon commander of an anti-aircraft battery control.

The volume of dirt excavated is 3.0 m^3 . 4.0 manhours are required for construction. a) profile N-1; b) profile N-2; c) position for observation; d) concealed cover; e) profile N-3.

It is advisable to construct a cover made from flooring above a concealed cover for observation for protection from bullets and fragments, incendiary agents and bad weather. A 10 cm layer of dirt is laid above the flooring, water insulation is laid on it (clay, rolled material), and a layer of earth 30-40 cm deep is placed on this. The cover must not rise above the surface of the trench parapet.

A structure for a chemical observation post is constructed the same as a structure for an engineering observation post. In addition, one of the positions for observation is adapted for setting up a gas detector.

The methods and means of camouflaging structures for observation depends on the place of disposition of the observation point and the type of structure. For camouflaging structures first of all it is necessary to utilize the camouflage means of the terrain.

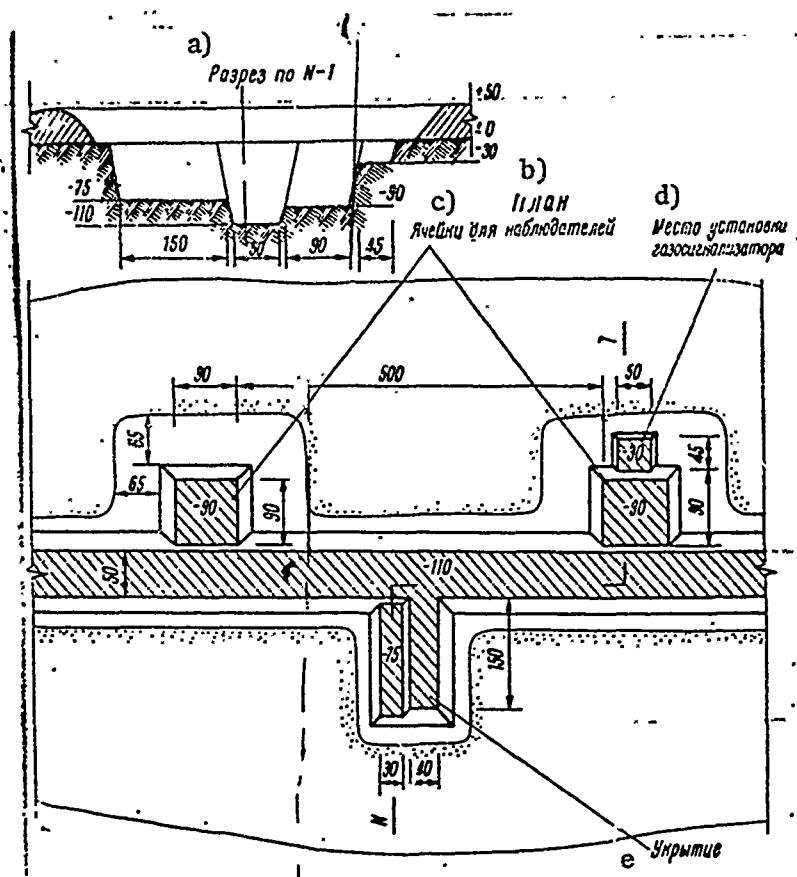


Figure 75
A structure for observation at an engineer or chemical observation post.

The volume of excavated dirt is 3.5 m^3 . 5.0 manhours are required for construction. a) profile N-1; b) plan; c) positions for observers; d) place for installing a gas detector; e) concealed cover.

Open type structures for observation situated in a trench or a dug-out position are camouflaged with a raised camouflage-overhead cover in imitation of the terrain background surrounding them (Figure 76). Authorized camouflage and camouflage material at hand are used for construction of the camouflage-overhead covers.

An observation point located outside of a trench is also camouflaged in imitation of the terrain background surrounding it. If a communication trench situated outside of a trench leads to an observation point it is concealed by using flat overhead covers or by constructing a dummy communication trench running alongside the real observation point to some kind of dummy structure. If there are no communication trenches but there are only paths leading from the nearest concealed cover to an observation point they are continued to existing roads.

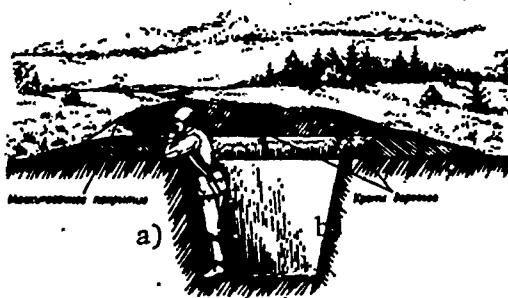


Figure 76
The camouflage of an open type observation point in imitation
of the terrain background.
a) camouflage cover; b) tops of trees.

When locating structures homogeneous terrains must be avoided
(cloud fields, meadows, mowed fields).

When an observation point is located in a destroyed population center
the structures for observations are situated in ruins or among local objects.
The camouflage of a structure for observation in imitation of a local object
is shown in Figure 77.

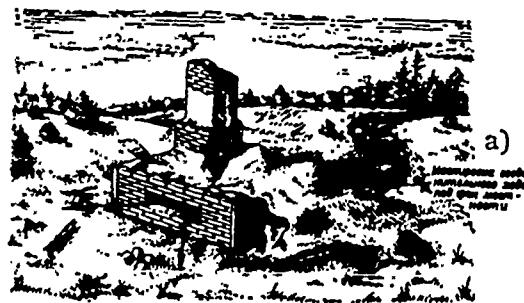


Figure 77
Camouflage of an observation point in a destroyed building.
a) The communication trench is camouflaged in imitation of the terrain.

Observation slits should be especially carefully camouflaged. Screens, frames and aprons with camouflage material corresponding to the background of the surrounding terrain attached to them are set up in front of the slit.

Camouflage nets are utilized as a basis for the aprons. Screens in frames can be portable and nonportable. When observation points are situated between bushes and trees the slits for observations can be camouflaged by planting bushes alongside the external opening of the slit.

CHAPTER 6

Organizing the Construction of Open Defensive Structures

It is impossible to build a large number of trenches, pits and concealed covers in a short time without the wide employment of mechanized facilities.

Trench digging and single-shovel excavators, trenching plows, bulldozers and tractor-mounted bulldozer equipment of artillery prime movers and tanks are employed for the mechanized excavation of open defensive structures. Earth digging machines can work in all soils except rocky. In frozen ground the work of trench digging excavators is possible with frost depth up to 10 cm, and of single shovel excavators with frost depth up to 40 cm.

Frozen soils where the frost is quite deep and also rocky soils are most effectively developed with the aid of explosives and pneumatic and hammer drills and electric boring machines.

The rotor trench digging excavators KG-65 and ETR-152 are employed for digging trenches and communication trenches up to 1.5 m in depth, and in width up to 1.1 m at the surface and 0.6 m along the bottom, with a 0.4 m high parapet.

The productivity of the trench digging excavators depends on the quality of the soil being worked, on the depth of the trench being dug and the design of the trench in the plan (curved or broken).

In soils of average density the productivity of an excavator is about 200 linear meters in an hour for a 1.5 m deep trench which has a curving design with a curvature radius of 50 m or a broken design with a 20-25 m long face.

The high speed trench digging machine BTM (Figure 78) is employed also for digging trenches and communication trenches up to 1.5 m deep, with a width along the surface of up to 0.9 m and along the bottom 0.4-0.5 m and a parapet up to 0.5 m high. The productivity of the machine when digging trenches and communication trenches 1.1 m deep in average soils is up to 500 linear meters per hour.

The trenching plow PLT-60 digs trenches and communication trenches up to 0.6 meters deep, 0.9 m wide along the surface and 0.5 m wide along the bottom with a 0.3 m high parapet.

The productivity of the trenching plow (with the tractor S-80) is about 1.5 km per hour of trench with curving design. Trenches excavated by the trenching plows are completed manually.

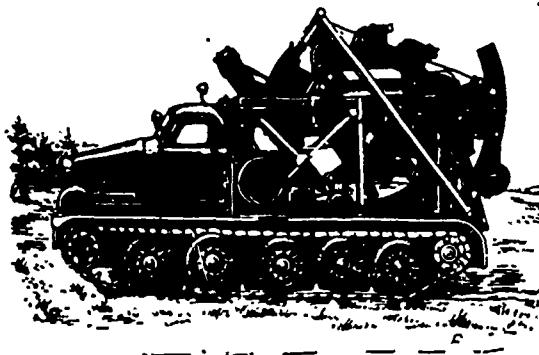


Figure 78
High speed trench digging machine BTM.

The single shovel excavators E-255 and E-302 dig pits and concealed covers for combat materiel and motor transport. The excavators can be equipped with a back or direct scoop (shovel) or crane. For excavating pits and concealed covers the excavator is most often equipped with a back scoop, by means of which it is possible to excavate ditches up to 3 m deep.

The basic tactical and technical data on the excavators is given in the following table.

Type of Excavator	Productivity, m^3/hour			Travel speed, km/hour	
	in loose soils	in average soils	in hard soils	under its own power	towed
E-255 with a shovel capacity of 0.25 m	45-50	30	25	to 12	to 30
E-255 with a shovel capacity of 0.35 m	70	40-45	-	to 12	to 30
E-302	75	50	-	to 13	to 30

The bulk and poor mobility of the excavators are shortcomings which hamper their employment for excavating defensive structures in areas accessible to enemy ground observation. Such earth digging machines as the bulldozer or prime movers and tanks with mounted bulldozer equipment are more effective in this area.

The bulldozer equipment is a powerful mounted (detachable) steel moldboard which is attached by side pushing beams to the frame of a tractor, prime mover or to the body of a tank. The moldboard can be raised or lowered by means of a hydraulic or rope-block control system. Some types of bulldozers have a moldboard whose position can be changed not only vertically but also horizontally. Such bulldozers are called universal.

Bulldozers are employed for excavating pits and concealed covers for combat and transport materiel up to 3 m in depth, for laying columnar routes and roads, for building embankments, for constructing approaches to river crossings, for filling ditches, shell holes, pits, trenches and for leveling emplacements. The mounted equipment of prime movers and tanks are used by artillery and tank podrazdelenie to do their own excavations.

The length of the moldboard, productivity and travel speed of the vehicles listed above are given in the table below.

Nomenclature	Length of moldboard, m	Productivity during excavation of pits and concealed covers, m ³ /hour	Travel speed, km/hour	Remark
Bulldozer D-271	3.0	to 80	6-8	
Artillery light prime mover (AT-L) with mounted equipment	2.5	to 60	to 35	The productivity of the vehicles is given for their operation in loose and medium soils
Artillery medium prime mover (AT-S) with mounted equipment	2.8	to 80	to 35	
Artillery heavy prime mover (AT-T) with mounted equipment	3.0	to 100	to 35	
Tank with mounted equipment	3.4	to 150	to 40	

Before work is begun on construction of the open defensive structures they are planted and marked off on the terrain. The fixing of a place on the terrain for the structure is called planting the structure. During the planting consideration is given the mission and the possibility of accomplishing the combat task from the structure, and also the camouflage and protective features of the terrain. Furthermore, the area for the structure should permit the employment of mechanical facilities. The area selected for the structure is marked off on the terrain by a peg or other sign placed in the center of the future structure.

For open fire structures a place is selected from which the terrain is covered with fire in the assigned sector at the distance of actual fire by the weapon mounted in them. For conducting flanking fire it is advisable to position structures on the back slopes of elevations and behind natural covers. Structures for conducting circular fire can be constructed on level terrain.

Structures for observation are located so as to insure observation in the directions and at the distances corresponding to the mission of the observation point or post.

Trenches are situated so as to most fully utilize the fire power of the infantry weapon, to create a system of flanking and oblique fire providing for covering fire on the approaches to the trench. Communication trenches and concealed covers are so situated on the terrain to utilize to the maximum the protective and camouflage features of the terrain.

The marking off of trenches and communication trenches provides for marking them on the terrain with stakes. Stakes of up to 2 m are placed in areas where the direction of the trench or communication trench changes. The changes in direction of a trench and communication trench are created by turns of the earth digging machine (within the limits of its technical possibilities) moving from one stake to another. At night and when visibility is poor the angles of turns are marked by lighting engineering and other means visible in darkness. Furthermore, guides are designated to move in front of the machine and show the route to the driver.

The marking off of pits for artillery and concealed covers for combat and transport materiel (excavated by using mounted equipment) is carried out in two steps. First, the central peg of the structure is marked, and furthermore, in pits the basic direction of fire is staked out and plotted. In the second step that part of the structure which the mechanism excavates is marked out. For this two-meter stakes designating the beginning and end of the ramps and horizontal part of the structure ditch are set up parallel to the longitudinal axis of the structure (in pits for artillery parallel to the basic direction of fire) for a distance of 0.5 m from the lips along both sides of the structure. After the mechanism's work has been done the marking out and plotting of the manually excavated elements of the structure are carried out.

If the pits and concealed covers are to be dug by an excavator their marking off is designated by pickets placed at the corners of the structure.

The organization of the work of the mechanisms engaged in the excavation is of great importance for reducing the time of constructing the open structures. Thus, a reduction of 10-15 minutes for excavating one structure with a volume of 60 m³ of excavated soil permits one unit of mounted equipment with a machine productivity of 80 m³/hour to dig an additional two-three structures in one shift.

Let us consider the sequence and methods of construction of several open structures where mechanized means are employed.

A trench or communication trench is dug by a rotor excavator using guiding lines placed along the axis of the trench or communication trench.

If it is necessary to excavate the trench or communication trench on the slope of a hill which has a lateral incline of more than 10° a preliminary path for moving the excavator is leveled out by using a grader or a bulldozer.

Before beginning the excavation of trenches for artillery and tanks, and also on concealed covers for materiel, it must first be determined which elements of the structures can be excavated mechanically and which manually.

All trenches and concealed covers for combat materiel and motor transport can be divided into two groups according to the conditions for mechanizing the work. Structures which have a trench width of up to 3.5 m excavated manually belong to the first group. The majority of concealed covers for automobiles and other special materiel, and also trenches for anti-tank and anti-aircraft artillery mortars, belong to the same structures.

Trenches for 122-mm and 152-mm caliber self-propelled artillery mounts and weapons belong to the second group. The width of the structures of this group are 3.5 m and greater.

The construction of concealed covers which are up to 3.5 m wide on the surface (Figure 79) begins with marking off the structure. The structure is marked off by using two meter stakes placed to designate the horizontal platform of the structure and the ramps. The excavation of the pit and ramps is done in layers 6-12 cm thick. A bulldozer or prime mover with mounted equipment moves along the longitudinal axis of the structures, like a shuttle, shifting the soil to two moldboards.

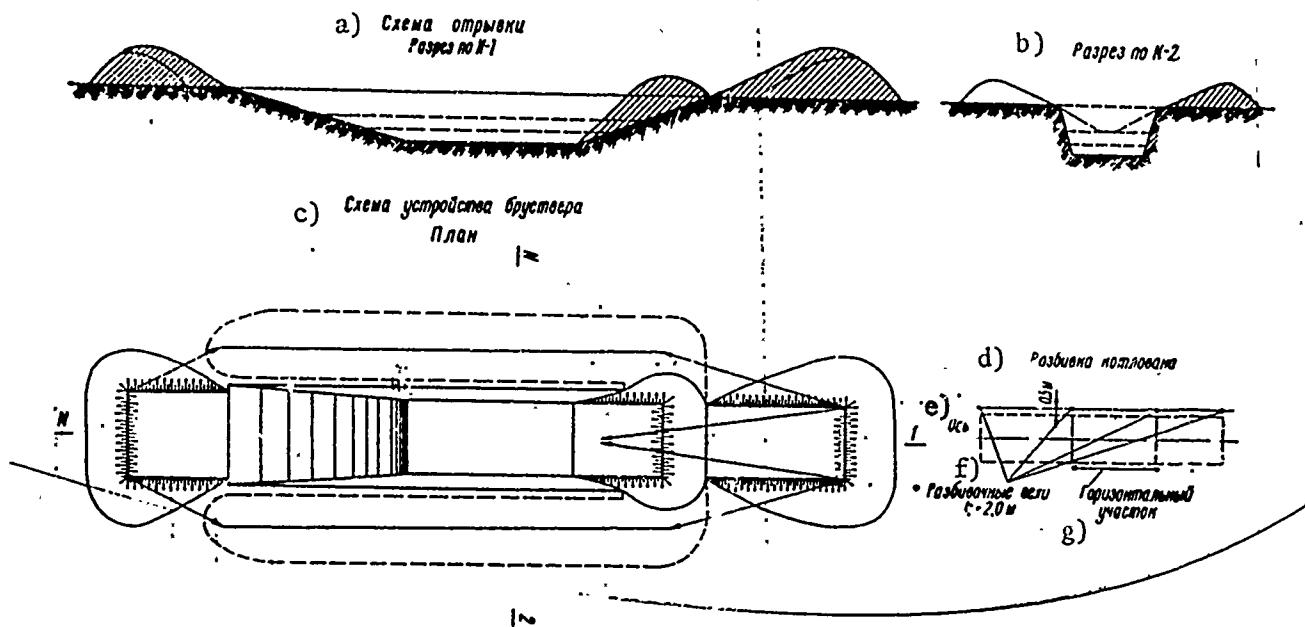


Figure 79
A concealed cover up to 3.5 m across the bottom excavated by a bulldozer.

a) diagram of excavation, profile N-1; b) profile N-2; c) diagram of the construction of the parapet, plan; d) marking off the ditch; e) axis; f) marking stakes, $h = 2.0$ m; g) horizontal sector.

The parapet is constructed from the dirt of the moldboards formed during the excavation of the ditch. The parapet is shaped manually and with the aid of mechanisms. When constructing concealed covers with one filled ramp dirt is first transferred from the moldboard located by the ramp for entering the structure. The excavation of concealed covers which are more than 15 m in length in the plan is done in layers in turn, first on one half of the structure and then on the other.

The excavation of trenches for anti-tank and anti-aircraft weapons is done in layers along the longitudinal axis of the structure with the dirt being moved by two moldboards. At the same time dirt is being manually cut away from the slopes in order to impart the designed outline in the plan to the trenches. The slits and recesses for ammunition are simultaneously excavated. When the work on the trenches is completed construction is begun on the parapet. If there is not enough dirt in the moldboard for construction of a parapet it is taken from the reserve. After the parapet has been banked it is made to conform to the planned profile by using a bulldozer.

Trenches for 122-mm and 152-mm caliber weapons (Figure 80) are excavated the same as trenches for anti-tank and anti-aircraft weapons. Here the bulldozer makes two runs to insure the necessary width of the ditch. The ditch is deepened along its entire width at the same time. Furthermore, the same work is done manually which was done in excavating trenches for anti-aircraft weapons. When excavation of the trench is finished work is begun on the parapet.

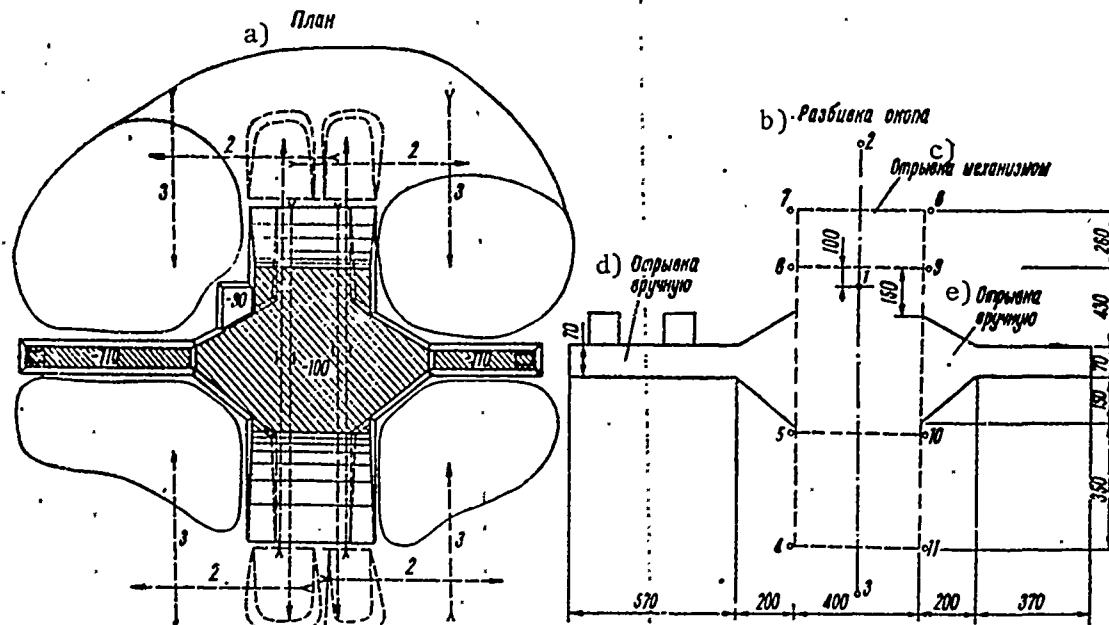


Figure 80

The excavation of a trench for 122-mm and 152-mm caliber weapons using a bulldozer or mounted equipment on an artillery prime mover.

- a) plan;
- b) marking off of trench;
- c) excavation by mechanism;
- d) manual excavation;
- e) manual excavation.

If the excavation of trenches and concealed covers is done at night using a prime mover with mounted equipment the front headlights and search light are covered for camouflaging the operation, leaving a narrow slit in them. A flashlight is attached to the rear of the prime mover on the left side in the direction of movement of the vehicle so that the wall of the excavated ditch is illuminated and the driver is enabled to correctly steer the prime mover.

When excavating trenches and concealed covers manually success depends on the quality of soil, the dimensions of the structure, the time of year and the time of day. All soils are divided into loose, medium, hard, rocky and frozen according to the difficulty of working them.

Vegetable soil, sand, sandy loam, small and medium gravel, and also peat which are easily worked with spades, belong to the loose dirts.

Large gravels, dry loess, heavy loams and rich pure clays belong to the medium soils, these soils are difficult to work with a spade. 1.0 m³ of soil can be excavated in one hour.

Heavy breaking clay, shale clay, tripoli, chalk rocks, and large pebbles belong to hard soils. They can be worked with spades only after preliminary breaking up by pick mattocks, sledge hammers and hoes. 0.5-0.6 m³ of hard soil can be worked in one hour.

After the marking off and plotting of the trench or concealed cover each soldier is allotted a sector, the dimensions of which correspond to the norm for an entire work day. So that the workers do not disturb each other each is allotted a sector 1.5-2.0 m wide and no less than 2.0 m long.

For digging trenches and concealed covers in hard and frozen soils besides the spades, one crowbar, a steel hoe, a sledge hammer weighing 4-6 kg, two light and one heavy pick mattocks are issued for every 7-8 men.

Frozen soils are best worked in the following manner. On a sector where the soil will be worked for one shift, the snow is cleared away, but the snow is not removed from the adjoining sectors so that the depth of freezing will not be increased. Next the working of the soil is begun without any break in the work so that the bared layer of soil will not be allowed to freeze. The soil is broken up with pick mattocks, crowbars and hoes, separating individual chunks from the mass, which are then removed from the ditch.

The breaking up of frozen soil is most effective when explosives are used, and also when heated by fires.

To conceal the defensive structures their camouflaging is begun simultaneously with their construction. The majority of terrain engineering operations must be done at night. If all of the work cannot be done in one night it must be so organized that by the end of the first night all of the earth work will have been stopped and camouflaged. During the second night the assembly of the structure banking it and the camouflage will be done. In this case the enemy will not know where and just what kind of structure was constructed.

Transport construction material and prepared formations of the structures are carefully camouflaged; this applies especially to elements made from corrugated steel which are easily recognized when observed from high altitudes.

If the installations are camouflaged by horizontal covers the following order should be observed when setting up the camouflage:

- mark the places for setting up stakes and anchor pegs;
- put the stakes and anchor pins in their places;

- prepare the frame and fasten it to the stakes, and at the same time fasten the upper ends of the braces to the stakes;
- drive in the anchor pins and fasten the lower ends of the braces to them;
- after this raise the stakes and test the tension of the braces and upper structure of the frame; if necessary tighten the frame or the braces;
- lower the stakes to the ground, having placed the lower ends within the outline of the cover;
- unfurl the camouflage cover above the frame;
- simultaneously raise the stakes with the camouflage cover; if necessary tighten the camouflage cover.

To set up a horizontal cover a crew is assigned equal in number to the number of stakes. Camouflage material at hand is interlaced in the cover on the side away from the area where the cover is set up before the cover is attached to the frame. When a horizontal cover is set up in shrubbery the branches of the bushes are attached to the cover in separate patches corresponding to the size and shape of the real bushes. The branches must be inserted and secured in the net in a vertical position, threading their large end into the mesh and tying together several branches below in a bunch. Branches no longer than 0.5 m are laced in the net.

Cut foliage is interlaced into the net thickly in the center of the cover and thinner towards the edges.

The clumps of grass taken for interlacing in the net are long (30-40 cm) so that the grass will not be blown out by a strong wind. The upper structure of the camouflage frame is tied clear of the area where the camouflage is set up. To this end four 10-cm pegs up to 1 m high are driven into the ground. The distance between the pegs is taken to be equal to the span of the camouflage cover. The upper structure is tied separately for every section (the area between the adjoining four supports).

The operation of setting up a horizontal camouflage cover can be divided up as follows: four soldiers interlace material at hand into the cover; two soldiers prepare the camouflage frame and the braces; two soldiers prepare the supports and anchor pegs; the squad commander and one soldier mark out the place for setting up the camouflage cover.

The camouflaging of troops is done without waiting for an order to do so. The construction of dummy installations is usually begun upon the order of the commander of a podrazdelenie or a chast.

It should always be remembered that camouflage without the observance of its requirements is useless.

CHAPTER 7

Recommended Methods of Conducting Training

The experience of troop combat training shows that in podrazdelenie where a great deal of attention is given the construction of pits, trenches and concealed covers the soldiers and sergeants know how to quickly dig trenches, to adapt terrain features for combat, and to conceal and camouflage combat materiel. Sometimes some commanders of podrazdelenie complain of not enough time being allotted to engineer training. However, experience shows that where engineer training is skillfully combined with tactical training, there is sufficient time for teaching the construction and camouflage of pits, trenches and concealed covers.

The majority of engineer training exercises are usually conducted on a firing range, in an engineer camp, on a tank drome or in any terrain section set aside for training.

In addition to field training some training classes can be conducted in a specially equipped classroom. There is in every chast such a classroom where there are models of defensive structures, posters, and structure construction elements. The classroom sessions help soldiers and sergeants master and strengthen their knowledge acquired in field exercises.

To make the exercises a success instruction in the construction of defensive structures should be accompanied by short explanations. For example, when constructing a one-man foxhole for standing fire it is necessary to explain what advantages this trench possesses in comparison with the location of a man on the open terrain. Along with this it must be demonstrated how to conceal oneself in a trench when there is an atomic explosion. When teaching the methods of constructing trenches and concealed covers for materiel it is necessary also to tell about the protective features of trenches and concealed covers.

Every driver and crew, as a rule, knows the dimensions of the materiel assigned to him. This facilitates remembering the dimensions of trenches and concealed covers constructed for the materiel. It is sufficient to explain to the soldiers the relationship of the dimensions of the materiel and of the dimensions of the concealed cover (for example, to point out that the width of the cover along the bottom is made 0.5 m greater than the width of the vehicle, and so on), and they will easily master the dimensions of trenches and covers.

For a deeper knowledge of the methods of protection against large scale casualty-causing means, it is necessary in the process of training to teach the soldiers to construct such covers as open and closed slit trenches, recesses, blindages and shelters.

Let us examine examples of how engineer training exercises should be prepared and conducted. Let us assume that the platoon commander intends to conduct an exercise in the platoon on the topic, "The excavation and organization of trenches". On the day before the class is to be conducted the platoon commander makes ready the entrenching tool, a laying out cord and the necessary materials for conducting the class.

He makes up beforehand a plan for conducting the class in which the training problems, place and time of conducting the class are listed.

The classes are usually held in the terrain or an engineer camp. First the students are familiarized with the construction of trenches and covers, and their protective features are designated. Trenches and protective covers are demonstrated best of all in an engineer camp, and if there is none then on posters or mock-ups.

In explaining the purpose of trenches it should be especially emphasized that they are first of all firing positions and they must provide the opportunity for carrying out their combat assignment. In order to explain the construction of a trench it is sufficient to organize a trench for a squad and a protective cover along with it in the form of a slit trench or an overhead covered section of a communication trench 3-4 m long.

We shall give an example of a plan for classes made up by a platoon commander.

Plan for Conducting a Class on Engineer Training with the 3rd Rifle Platoon

Subject of class: "Excavation and organization of pits, trenches and concealed covers",

Time: 3 hours,

Location of class: training field.

No. according to tentative schedule	Training problems	Time allotted in minutes
1	Purpose and basic dimensions of the elements of a trench and concealed covers for a rifle squad	15
2	Selection of location, marking off and laying out of a trench (concealed covers) for a squad	10
3	Distribution of work among squads of platoon	5
4	Excavation of a trench for a squad and equipping of a trench with concealed covers (slits and recesses)	100
5	Camouflage of a trench with camouflage facilities at hand	10
6	Review and summing up of class	10

One of the basic tasks of engineer training of all the branches of the army is to instruct soldiers how to organize and camouflage positions. In order to train rifle podrazdelenie, weapons crews and tank crews to carry out the entire series of operations involved in organizing and camouflaging and concealed covers, squad commanders (sergeants) must know well how to construct structures, the methods and means for camouflaging them, and also how to utilize mechanized facilities with greater effect. Furthermore, they must know how to pass on to the trainees and make easily understood their own practical skills.

In the following example we will see how to organize and conduct a class with the personnel of a fire platoon.

Usually 4-5 training hours are allotted for the subject "Excavation, organizing and camouflaging a weapons pit", and furthermore, in treating the individual problems of this subject it is advisable to divide this time in the following manner.

No. according to tentative schedule	Training problems	Time allotted in minutes
1	Purpose and basic elements of trench	20
2	Selection of location, marking of and laying off of a trench with a narrow sector and a circular field of fire	20
3	Excavation and equipping of a trench, slits (blindages) for personnel and recesses for ammunition using mounted equipment and manually	150
4	Camouflaging a trench with authorized facilities and with facilities at hand	40
5	Familiarization with the construction of trenches in special conditions	10
6	Review and summing up of classes	10

This subject is treated in one or two classes lasting 2-3 hours each. In the first class the trainees are familiarized with the basic elements of trenches, the methods of marking off and laying out trenches are treated, and they are familiarized with the methods of digging trenches mechanically, manually and by means of explosive materials. The equipping of a trench and other problems of this subject are treated in another lesson.

Several days before the classes are conducted the commander of the company (battery) conducts an instruction-methods class with squad (weapons) commander. In it he explains to the sergeants how to organize and conduct the class, he helps make clear the basic problems which are to be treated with the soldiers, and he points out how much time they

must allot to this or that problem and what to take with them to the classes.

When treating a given subject for a lesson it is necessary to take stakes, marking off pegs, a laying out cord, an entrenching tool, and also models of TNT charges (for teaching the construction of charges). In addition, a prime mover with mounted bulldozer equipment is allotted for this class. If there is no prime mover, take posters and models which show how to excavate trenches mechanically and using explosive agents.

On the eve of the class it is desirable to show the personnel of a fire platoon around a training field where there are trenches for weapons already equipped and camouflaged with authorized facilities and facilities at hand.

In the beginning the class instructor points out that the location of trenches for weapons above all must insure the completion of the combat mission, that is, they must be carefully adapted to the terrain and situated so that the materiel and crew are barely perceptible from ground and air.

Next the instructor explains the basic elements of trenches and the purpose of each element in particular. After this the marking off, laying out and excavation of the trench is begun. First the excavation of a trench by means of a prime mover with mounted bulldozer equipment and finishing up manually is demonstrated, and next a trench is dug completely manually.

After a practical excavation of a trench the instructor of the classes explains to the personnel the methods and means of camouflaging trenches and different terrain conditions and times of year by using authorized and provisional camouflage facilities.

The construction of trenches in special conditions (in winter, in marshy or in rocky soil) is explained by the instructor making use of posters and models.

At the end of the class the instructor briefly reviews and summarizes the class and tells the students that the basic skills which they have acquired in this class must be systematically perfected in tactical exercises, training and field firing.

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13. ABSTRACT <p>→ This booklet, designed for sergeants and junior officers, describes the construction of the basic open defensive structures for infantry tanks, artillery and other combat material and motor transport. The disposition of these structures in the terrain and the utilization of its protective features are outlined. Both mechanical and manual methods of excavation are given, and numerous diagrams of the fortifications, with dimensions, are included. Camouflage procedures for all types of structures are fully described.</p> <p>The construction of primary open defensive installations for infantry tanks, artillery, and other military equipment and motor transport is described in the brochure; the disposition of these installations, as well as the use of local protective and camouflage facilities is given. The authors discuss the methods of erecting and camouflaging defensive installations by means of mechanical facilities.</p> <p>The figures contained in the brochure facilitate the study of the defensive installation, their individual parts, and designs.</p> <p>The brochure is designed for sergeants and junior officers of all branches and it can be used by them as an aid for the study of defensive installations.</p>		

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trench trench-digging machines camouflage cover atomic explosions recess slit trenches tanks self-propelled weapons connecting trench field of fire blindage embrasure parapet dummy structure						

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